

UNITED STATES EMBASSY INL SECTION



**A&E DESIGNS FOR A NEW LODGING BUILDING AT THE CNP AVIATION SCHOOL
IN MARIQUITA TOLIMA**

TECHNICAL SPECIFICATIONS



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INTRODUCTION

The project “A&E DESIGNS FOR A NEW LODGING BUILDING AT THE CNP AVIATION SCHOOL IN MARIQUITA TOLIMA” is located in an area adjacent to the main school access **by the west side of the access road**. This is a slightly inclined lot with a west-east slope. The building will be located in the area between the existing parking lot and the security ground ridge built next to the guard shack.

The new development consists of a two story rectangular building that was functionally organized in two identical modules articulated by a central staircase that connects them. Each module has 20 rooms located along a central corridor. These corridors lead to emergency stairs found at both ends of the building.

Each room has two beds, includes a working desk area, a double wardrobe and a bathroom. The bathroom has a cabinet with a toilet and a shower with natural ventilation, and a separated area with the sink. Additionally, the rooms will have a system network installed for a 12.000BTU minisplit type air conditioning equipment and a TV outlet.

OVERVIEW

These specifications are related to the “A&E DESIGNS FOR A NEW LODGING BUILDING AT THE CNP AVIATION SCHOOL IN MARIQUITA TOLIMA” All inclusive” construction project at a fixed global price with no adjustment formula. The characteristics, type and materials to be used in the construction are listed here as a complement to the construction plans and drawings. The conditions and construction characteristics related to the usage of the materials that are in the drawings and plans are stipulated, but in no case do these constitute a manual for construction, clearly understanding that the builder is a suitable, competent and experienced professional and has the necessary equipment for the project.

The builder should pay special attention to the fact that the building described here is next to the base helicopter platform which subjects it to especially high wind loads. The structural design of the project has to take into account said loads, it is the builder’s responsibility to guarantee the stability of all parts of the project. This document describes the process of activities involved in the project but it is the builder’s responsibility to make sure that the building processes comply with the Colombian or US norms in force when necessary.

Any change in the specifications, the drawings or in both will be integrated into the structure by the contractor. Such changes will not subject the contractor to liability after the fact.

All the materials specified herein are to be new and of top quality and their installation and performance are the responsibilities of the contractor. Where a material(s) or manufactured product(s) of a specific brand name is specified, it should always be understood, that it is only to indicate the required quality of the products and materials to be used or any other equivalent.

The contractor shall supply the materials, fixtures, construction equipment, tools, and labor necessary/required to complete the construction. The method of installation, application, set up and location should be in accordance with the definitive or final specifications and drawings approved, to the recommendations of the manufacturer and to the requirements and necessities of the project. The contractor is responsible for the appearance, functionality, durability and proper installation of materials, equipment, and fixtures. The contractor is further responsible for the correction, at his cost, of any defects or substandard work in construction. The contractor shall present a detailed list of materials, fixtures, paint (colors), fixtures and equipment 15 days prior to starting the final architectural drawings. Any significant change in building

materials (cement, sand, gravel, additives, etc.) constitutes a change in the design and must be submitted for approval, with tests and material data sheets. Materials or other elements that have been acquired by the Contractor without meeting these conditions will not be recognized nor accepted. As a general procedure the Contractor shall offer manufacturer samples of any material for approval.

The Contractor is fully responsible for the condition of the structure, its contents and its appearance and shall guard against any deterioration or damage until the final acceptance of the works.

During the bidding phase for construction, only the Contracting Officer shall be consulted, in any case of doubt either due to lack of clarity in the specifications or real or apparent error or discrepancies between the drawings and the measurements on the site. This should also be clarified with the designer. The contractor will keep an updated record of architectural, structural, electrical, hydraulic and sanitary drawings and plans as well as finishes, communication and controls which will be used only to indicate the modifications done on site. At the conclusion of the job clean copies of these drawings and plans shall be made and turned over to the INL section on site as 'as built' plans accurately reflecting the finished site. In this project the drawings and architectural specifications will have the same priority. If discrepancies are found, the builder shall advise INL in writing in order to determine a solution with the designer.

The contractor will abide by the norms established by the Colombian National Police, in reference to the entrance and exits of personnel, identification, vehicle circulation, time schedules and permits in coordination with INL section of the United States Embassy.

TECHNICAL SPECIFICATIONS

The purpose of this document is to clearly define the parameters to which the United States Government or its representative, contractor, and others involved must adhere to, so that the construction criteria are unified and the best quality results are guaranteed. These specifications are complemented by the norms established for industrial safety and environment impact with current Colombian construction norms or by the corresponding American ones for each activity. At the same time we will describe those aspects related to the specifications that must be met by the contractor to get the desired quality. These aspects will be studied in the general guidelines.

ENVIRONMENTAL SAFEGUARDS

All construction procedures or activities that may have any impact on the environment shall be conducted in full compliance with all local laws and regulations to ensure little or no effect on the local or surrounding environment including the health of people, animals and vegetation but rather be oriented to its protection, conservation and improvement. The contractor awarded the bid must develop an environmental protection plan (if required by law and previous confirmation by base commander) which must be prepared by properly trained personnel. A copy of the plan must remain on site at all times and compliance will be mandatory for all construction and personnel on site.

INDUSTRIAL SAFETY AND OCUPATIONAL HEALTH

The contractor will observe all current workforce safety laws and regulations as published by "Ministry of Labor" for the protection of employees and the general public on or in close proximity to the work site could be affected by the execution of the job directly or indirectly. For any work executed on heights its mandatory to comply with the 1409 of 2012 bill of the "Ministry of Social Security

All personnel will be supplied with overalls of the same design and color by the shift they are assigned to or long pants and shirt of the same design and color. Boots, hardhats, gloves and more specialized safety gear such as face masks, ear plugs, safety belts, etc, the use of which will be mandatory on site. All personnel must carry an I.D. badge with name, i.d. number, photo, and occupation. Any non-compliance with these requirements will result in a work stoppage until the fault is corrected.

SOCIAL SECURITY REGIMEN

The contractor will be obligated to enroll each one of its workers and subcontractors in the general system of Social Security for health, the general system of professional risk according to Act 50/1993 and the general retirement system Act 100/1993 coverage must be secured through a EPS (medical insurance), an ARP (professional risk administration) and to a pension fund authorized by the Colombian government. The contractor will make the proper arrangements and payments to the above mentioned entities so that coverage is in force for the duration of the construction project. No access to the site will be allowed until such coverage is in force. The Contractor will demonstrate compliance to the Embassy by supplying copies of receipts from said entities on a monthly basis.

SUBCONTRACTORS

Subcontractors must be able to demonstrate proper training, experience and knowledge of the proper building techniques to satisfy the United States Government or its representative. The contractor is responsible for any substandard or improper construction done by a subcontractor task.

It is incumbent on the Contractor to lay out specifications and job site rules and to properly supervise the subcontractors and to make whatever arrangements for indemnification are suitable between the parties concerning faulty work.

MISCELLANEOUS

Logistics

The following chart describes the activities and logistics for the operation in the school during the works.

REQUIREMENT	PROCEDURE
Construction permits	In order to get the licence or permits to the development of the works inside the school the contractor must address the infrastructure office of the ADMINISTRATIVE AND FINANCE DIRECTION "DIRAF" . This office is in charge of issue construction permits. The contractor must contact Lt. Juan carlos Parra Ariza.
Schedule	From 06:00 to 18:00 hours
Schedule extensions	The contractor must send a letter to the school direction explaining the date and the activities to carry out
Personnel feeding areas	Dinning Room and cafeteria
Materials location site	Inside the camp area
Allowed transit areas	Access roads, parking lot, working areas.

Restricted areas	Existing Buildings and aircrafts platform.
Personnel access required documents.	Cedula de Ciudadania (ID) Copy Disciplinary record issued by colombian "Procuraduria" and National Police A 3x4 photo no hat blue backgrownd. Phone numbres and address Two famuly references. Two Personal references. Two work references including phone number. Work on hights certificate. All information will be subject to verification
Personal safety and dress code	Bright orange overalls branded with the company logos. Industrila helmets. Allowed colors according with the work activities: red, yellow, blue and white. Steel toe industrial boots
ID cards	The layout of the ID cards must be according to the image manual of the Colombian Nationa Police.
Vehicle documentation requirements	Property card copy. Valid SOAT copy Valid Technical-Mechanic review copy Driver's ID (Cedula de ciudadanía) Identification card accordin to the image manual of the Colombian Nationa Police.

Scheduling

The contractor shall specify the time needed to meet the objectives of the overall project based on calendar days with allowances for unforeseen delays and weather or seasonal factors.

The embassy will consider extending the time line for the turn-over of the job in the event of extreme weather conditions or days of rain that exceed monthly norms for the last 5 years as determined by the data from the closest IDEAM station.

The contractor must also include time spent on obtaining personnel access permits to the base and the time for INL design review, calculations, tests and samples for the project (average 5 working days for each submittal) and the time that the contractor requires for their correction.

When the work is started, the contractor shall give a detailed schedule of the work with projected dates for the different jobs showing the critical parts of the work as well as the days for the submitting of materials, tests, etc. and key visits to the work for information and inspection purposes and a diagram of work activities with values. This diagram must be updated every fifteen days with an additional graph showing the actual vs. projected progress.

Quality of the work

The contractor will be solely responsible for the quality of the work whether done by his direct employees or subcontractors and, therefore, any damage, defect, necessary repair, or improperly completed parts of the work including subpar finish work will be his responsibility.

Quality will be determined by technical specifications of the project corresponding to Colombian norms. It must be specified that where no Colombian norm exists, American codes/norms will apply. The contractor must include in his proposal, the tests and profits necessary with results turned in prior to beginning next stage and a compendium of all of them in the final report.

The acceptance of designs, calculations, plans, and / or work by the Embassy, will not exempt the contractor from complying with codes and norms corresponding to design and construction.

The contractor must check the designs given by the Embassy; in the event errors or inconsistencies are found, he must indicate them in his proposal and in the technical volume and propose correction options and their costs.

Intellectual property and privacy of plans and design

In accordance with norms regarding intellectual property and copyrights, it is understood that the plans, calculations, and designs concerning and arising from this project, belong to the government of the United States of America, which may use them partially or totally for other projects and the designer will receive the corresponding payment agreed in the work order or contract.

The contractor will have the obligation to adopt all the necessary policies and safeguards to maintain the privacy and confidentiality of the information, documentation and other matters related with the work, shall not make any reproduction of this information or use the same in whole or in part for this or any other project without Embassy authorization. Any violation of this obligation will be considered a breach of their obligations that could result in contract termination, without prejudice to all other legal actions that may otherwise be pending or necessary.

Storage of materials

The contractor must have appropriate storage facilities on site for described materials, properly prepared based on provider recommendations for each material. The selection of a storage site(s), any improvements to existing structures or new storage structures the contractor wants to undertake must be approved in advance.

Stored materials must stay clean, free of grease, oil, paint and any other foreign matter that could reduce their quality and must be used in the manner, quantity and inclination recommended by the manufacturer.

Security and operation of the storage areas is the sole responsibility of the contractor.

Materials that do not meet quality or esthetic requirements will be returned at the cost of the contractor.

Vicinity memorandum

In order to protect the quality of the area the contractor shall, before beginning construction, make a photographic and written record of the condition of the site and its surrounding area. The record shall then be presented to the base commander or the designated person and residents for their comments and signature.

When the work is complete, the record shall be used to ensure that the work site and adjacent areas are undamaged or brought back to the prior level. Any necessary repairs will be at the contractor's expense.

If the contractor incurred damages to property, streets, green areas, etc, he will do the necessary repairs for a complete and correct compliance with terms of the contract without the mentioned repairs being additional cost for the project.

1 PRELIMINARY ACTIVITIES

1.1 VARIOUS PRELIMINARY ACTIVITIES

1.1.1 General Job site camp description

Description

The contractor shall provide for the temporary construction structures for all technical, administrative and accounting personnel at the site throughout the project, as well as storage and protection for materials, and equipment that can deteriorate if exposed to weather. A complex of bathrooms for the workers should be built that will have at least one bathroom sink and a urinal, for every 20 workers, and should be connected to the sewage system for the area or to a provisional septic tank if required. It must have at least one faucet for workers' use of water and another for cleaning toilets. In the event that there is an internal security guard for the site, a shower will be provided. It must have a service area with a complete sanitary installation. The contractor must provide the necessary cleaning personnel. The contractor shall determine if such housing or bathrooms are necessary, the most efficient means of supplying it, what building materials are needed, and whether portable toilets will meet the minimum requirements of the site. Its design and location will be determined in agreement between the builder, INL section representative and the Base representative. Once the construction is finished, the camp shall be demolished and removed by the builder. (See plan U-2), location suggestion.

Development

This temporary construction must be clean, hygienic and safe. Furthermore, the necessary areas must be provided in the course of the construction such as rooms for workers and subcontractors, storerooms, bathrooms, security guard rooms and offices, including one for the INL section with a table and two chairs, electrical outlets and a meeting room seating 8 people. Areas must be prepared that will serve for the storage of materials and equipment for prolonged periods of time

1.1.2 Temporary services

Should the end user render some service to the contractor, it will be non conditional and, in the event of termination, the contractor will not be able to claim economic loss or justify delays in the work on claim of failure of end user to provide aid.

The end user may help with connecting the services during the work but this is not mandatory for them. It is the responsibility of the contractor to ensure the supply system. There will be no additional time or budget in case of supply interruption.

1.1.3 Temporary electricity service

The provisional connection for electricity could be made by means of an electric generator that runs on fuel. Another option would be for the builder to start the procedures for and installment of the definitive electrical system as studied and provided for in the plans. The installation will be above ground at a minimum of 6 meters in height to avoid accidents and fires, on wood posts with insulated copper or aluminum wire. If a medium tension cable is used the builder should monitor power use and supply to the site. Temporary connection must be done technically and in accordance with updated norms. The contractor should have a general temporary circuit breaker box for electrical service in the project.

1.1.4 Temporary sewage service

The domestic type of sewage from the construction workers on the job will be removed by means of a temporary service which will be connected to the general system belonging to the base once all of the paperwork, permits and licenses that the base requires are done.

Suitable disposal of waste is the responsibility of the Contractor.

1.1.5 Temporary Water Service

For the proper installation of water supply, a formal request must be sent to the base ahead of time and the connection may be made. If they can not guarantee the supply, the builder must select a different source

Any temporary supply provided by the base is not to be depended upon. The loss of a temporary supply by the base will not excuse any delays or work stoppage nor will it be grounds for complaint or claim. Another alternative would be to start with the job of setting up the water connections and getting water from the pipelines that belong to the general municipal system. (See plan U-1). The contractor has the authority to verify and choose the alternative that best fits his requirements and budget.

If the supply is interrupted for any reason, the contractor shall guarantee a permanent supply of the water needed for the work. Therefore, the Contractor shall have water tanks available. The storage of water and the required supply are the responsibility of the contractor.

1.1.6 Fencing the site in ecological canvas and security tape

Description

The fencing for construction will be done with environmental canvas over wood studs set into the ground. The fence post holes should be dug to the depth of no less than 50 cm. The studs will be placed a maximum of 3.50 m apart and will have a minimum height of 2.50 m. Every third section will have a diagonal support for stabilization and with all the necessary parts for strength and stability. Studs must be the same or greater in length than the height of the canvas used. The material should be stretched taut over the fence framing without rips or folds. The installation will be agreed upon and checked with the Embassy inspector. The proper appearance of the canvas during the process of construction is the total responsibility of the contractor. In case that the contractor cannot set the posts into the ground, he must supply a system that guaranties the same rigidity as if they were fixed.

The enclosure for excavation material will be set up with security tape fastened to wooden uprights anchored in the ground. The depth of this will in no case is less than 50 cm. The uprights will be separated from each other by a maximum distance of 3.5 m and will have a minimum height of 1.50m above the ground. Three lines of tape separated from each other by 50 cm. will be fastened to them with the lowest at 50 cm. above the ground. The tape should be perfectly stretched without folds or tears. The installation will be agreed upon and checked by a representative of the INL section. It is the complete responsibility of the Contractor to keep this tape in excellent condition throughout the time the work is in progress. If it is not possible to drive the posts into the ground, the contractor will have to provide a system that will guarantee the same rigidity that driving them into the ground would.

1.1.7 Marking designation of the job site/ Safety signs

The builder will provide and install safety signs in and around the work site as well as along the designated supply route to the job site on the base. It will be done in accordance with the industrial security norms

requested by the end user and recommendations of the INL section of the US Embassy. The purpose is to prevent risks or accidents in around the work site. The materials to be used must be in reflective material, so that they can be easily seen during the day and at night.

1.1.8 Relocation of existing trees

Description

The trees that are within the construction area for the building should be relocated.

Development

The builder must contact the school commander to define the location of the existing trees within the building area. The appropriate tools must be used to guarantee the best result in this procedure.

1.2 SITE PREPARATION

1.2.1 Clearing, cleaning and removal of scrap (rubbish)

Description

The clearing of the site consists of the removal of the vegetation layer of the area, organic material, roots and all other rubbish that will interfere with the job. The superficial excavation that is done to an approximate depth of 20 cm by manual or mechanical means is considered the clearing.

Development

The clearing will take place in accordance with the particular conditions of the area, with the adequate mechanical equipment and following instructions of the Embassy inspector. The Care of Soil Studies will be strictly followed to allow a tracing and exact leveling of exterior areas, buildings and the camp.

The areas or zones subject to clearing will be designated in plan UPP-101. They are the zones for the buildings plus an adjacent area of 2 meters around the perimeter of the selected area, of the buildings and the camp where the area permits it.

The best of the topsoil will be set aside for lawns and planting areas. It will be stored in a convenient out of the way spot. This material cannot be used for any other type of fill in. Any other fill that is not usable on site is to be removed to a properly designated disposal area previously agreed upon. This material could be used as landscape filling, only if it doesn't have any kind of debris or thick material. The spare material shall be removed from the site and taken to a previously determined place in order to prevent from fines or penalties applied for the authorities or any other subsequent damages to the works or to external personnel. Any cost for fines shall be paid by the builder

1.2.2 Location and laying out

Description

This refers to the laying out of the building plans in accordance with the architectural plans using standardized procedures.

Development

The builder will do the layout of the buildings using precision instruments in compliance with the drawing, plans and charts. The horizontal reference will be the system of coordinates employed for site measuring. The height reference will be done starting from the BM and deltas used in the drawing. (See plans U-1The

builder will mark out the general exterior boundaries of the work site; as well its relation to the boundaries of the lot, roads and planned roads so that the work space may be segregated from the base.

Once the work site is defined the contractor may then, using the best available surveying methods and instruments layout the exterior dimensions of the building as described in the plans and descriptions. Every axis in the general structure will be laid out in a permanent and stable manner with guide lines anchored to stakes, white and color paint identification marks for ease of confirmation by the United States Government or its representative. The builder will maintain markings indicating the BM and other reference points.

Later level N=0.00 will be established so it corresponds to level +1049.50 m/sl of the actual terrain of the topographic drawings while keeping in mind that the levels of the area have been previously coordinated. The angles will be determined with transit that reads with at least a 1" precision. The distances will be measured with metallic tape. For the less important tasks, the 3-4-5 system will be used. The precision level will be used for sewer work while the hose level will be acceptable for brick laying. Once the foundation is leveled, the layout of the floor plan shall be done for each level of the construction before starting the steel distribution. Once the slab is poured and set, the structural support columns, walls and other necessary work will be layout again before starting work on them. Afterwards, layouts for masonry work will be done by redoing the structural axis basing from the columns and marking the slab with colored paint.

1.2.3 Removal of excess material

Excess material and debris will be removed from the lot to an authorized dumpsite outside the base, in a professional and orderly manner in full compliance with local norms and ordinances. Should the builder fail to observe any of those ordinances, he will be responsible for paying the fines. If the material is recyclable, an inventory must be given to the base commander or his designated representative showing the name, position, ID number and signature of the person receiving those materials. A copy must be sent to COR at the embassy.

2 EXTERIOR WORK

2.1 EXCAVATIONS

2.1.1 Manual Excavation, load and removal

Description

Manual excavation refers to the displacement of small amounts of soil for the purpose of trenching, pipe-laying, setting beams, structural supports and retention walls. Included in this item are the gathering, loading and transportation of debris and surplus material.

Development

In every case if it is cheaper or more convenient to do this activity by mechanical or manual means must be evaluated.

If the ground is firm or if the building is being done on top of fill, cuts will be vertical. However, if the ground is not consistent, inclined cuts will be done to ensure stability while using holding devices as little as possible. When the terrain is muddy or unstable, walls should be framed while advancing the cut. The framing will be done using horizontally placed wooden boards and held by securely planted studs. The frame can be used on unstable terrain if the excavations are deeper than 1 meter and there is danger of sliding. Soil extracted

from excavations should be placed at least a meter away from the border of the hole until it is removed from site.

2.1.2 Mechanical Excavation

Description

This specification refers to the moving of large volumes of soil needed for the levels and sub-bases in accordance with the existing ground level specified in the general plans, to the width of the sub floor slabs, pavements and other recommendations contained in soil studies.

Development

The generic depth of the excavation for the construction of the base, walls and tie beams will be done in accordance with the established in Soil Studies and dimension lines of the structural plans or drawings. The excavation will be done with mechanical equipment until the generic level corresponding to the sub-base of the sub floor slabs or flotation of the lower levels of the project is found. Additional excavations, if required for bases, foundation blocks, retaining walls, bases or tie beams will be done by hand in accordance with the recommendations in the previously mentioned studies. It will be excavated progressively evaluating levels of black elevation with stakes and thread on the boundaries of the excavation. Depending on the terrain, wall cuts will be made in such a manner as to avoid damaging dikes and thus maximize stability. Any cut that is in any danger of shifting will be protected by covering it with a layer of light concrete (concrete and sand in a 1:10 proportion) using wire mesh by request of the Embassy inspector or with the most convenient method possible in light of weather conditions.

When it proves necessary to go down to a depth lower than indicated in the plans and drawings, due to the terrain, the contractor should present a written authorization signed by the Soil Engineer. The Contractor must include this additional work in his proposal if he considers it necessary. The contractor shall verify all final excavation elevations for the foundation before starting foundations. The contractor will not be compensated in the event of delays or additional work due to cave-ins, landslides or alterations caused by his own work. Neither will he be compensated for excavation beyond that which was calculated for in the initial contract.

Should the contractor excavate to depths below those in the specifications, he will not be able to back fill and will thus have to pour a deeper foundation to bring the job up to spec. There is no extra compensation in that event. The contractor must keep excavations dry and free of debris to avoid alteration in the subsoil.

2.2 BACKFILLS

2.2.1 SBG-1 or SBG-2 Granular Sub base

Description

This specification mainly refers to fill that must be done around and beneath foundations, underground tanks, floor slabs and ditches for piping.

Development

The fill will be done in accordance with guidelines, levels, inclines and transversal sections shown in the general plans. Material for fill will be obtained locally and be the equivalent to the SBG-1 or SBG-2 approved by lab tests. Its type, quantity and method of insertion must be approved by the United States Government or its representative. Fill will be done over the previously cleared layer of soil chosen on the basis of soil studies. The chosen material must meet the selected size and quality characteristics. Material placing will be done on successive layers spread over the total width of the section before compacting. Material will be placed in

horizontal compacted layers with a depth of no more than 15cm. to reach the final fill surface which must support the slabs and upper surfaces at the designated level as designed in the plans.

The material of each layer must have the prescribed humidity based on the lab tests. The compacting will be done by manual or mechanical means to reach optimal conditions. In the event of inclement conditions such as rain, the work must be stopped. In order to maintain the fill at the stipulated humidity while being placed, it may be necessary to spray down the cut. This must be done with vehicles equipped to guarantee homogeneous distribution. Enough vehicles will be required to stay at the work site to be available to supply the needed water for compacting. A record of the compaction rates based on lab tests should be kept on site. The degree of compacting required is 95% of the maximum dry density obtained on the proctor test modified according to "AASHTO" regulations. The contractor will do modified proctor tests on representative samples, at least 3 from the living area and 1 from the service area. Precautionary measures must be taken during the compacting process in order to avoid undue stress on any structure and prevent fill from sliding away from where it was placed. The contractor will guarantee the stability of all fill and must repair any portion of it the United States Government or its representative considers damaged.

2.2.2 Fill-in with selected material

Description

This specification mainly refers to fill-in that must be done around foundations, underground tanks and trenching for piping.

Development

The fills will be done in accordance with guidelines, levels, slopes and transversal sections shown on the general plans. The maximum thickness acceptable would be 20 cms, The compactation density must be larger or equal to 90% of the density obtained in Modify Proctor test..

2.3 CONCRETE

2.3.1 Fluted Concrete for parking lot

Description

This item refers to the construction of parking lot as indicated in plans and drawings. An excavation will be done that is 50 cms. deep the residue and any infrastructure will be eliminated and the subsoil will be compacted. A non-woven #2.000 geotextile will be placed. A granular sub-base with Invias a-1 or sub-base B-200 type surfacing to a height of .20mts. After that a BG-1 (B-600) type granular base that is 0.15 mts. deep. The concrete slab must be .15 mts. in concrete with a flexural strength/modulus of rupture, fracture strength of $M_r=41.0\text{Kg/cm}^2$. These slabs will be reinforced with 3/8 reinforcing steel rods every 0.20 mts. in both directions or an equivalent welded steel wire mesh.

The detailed specifications for this item are found in the document that has the soil study attached to this report. Said soil study will be used as the controlling document for this item.

3 BUILDING WORK

3.1 CONCRETE

3.1.1 Concrete for structures

Description

The specified concrete indicated in the drawings should be supplied by a company that specializes in making concrete and that can fully certify its quality. In case ready mix concrete cannot be used, the contractor must include supplies of all material, labor, infrastructure and equipment necessary to prepare the concrete, the surfaces it will go on, the production of aggregate, measuring, mix, transportation, application, forms and consolidation of the concrete as specified as well as the supply and collocation of seals, joining sealants in accordance with drawings and specifications. The contractor shall also consult Soil Studies and foundations in structural drawings and for all cases; in addition, the following preliminary activities must be kept in mind:

THE CONTRACTOR shall verify excavations, foundation levels, locations and dimensions, top level of fill materials, mark out the positions of beams and columns over the sub base place and check steel reinforcement, supports and spacers for reinforcement. THE CONTRACTOR shall check the levels of overhead beams, reinforcements and cover to reinforcement, alignments and dimensions. The concrete must be poured progressively, vibrated manually or mechanically, and the final levels must be checked after it cures for acceptance.

Mixing

The responsibility for designing the concrete mixtures that are used on site falls solely to THE CONTRACTOR and it will be done for each class of concrete solicited in these specifications and with the materials that have been accepted, based on previous laboratory tests. Nevertheless, the mixture designs, the modifications and revised must be submitted 15 days in advance while indicating the specific structure or part of the construction where they are going to be used. All materials, methods of preparation and pouring of concrete are subject to approval. Before starting construction of any part of the job or when demanded by specification, THE CONTRACTOR must present representative samples, references and details of the materials intended for use for approval.

For each mix design that is submitted for approval, THE CONTRACTOR, at his own cost, must supply samples of the mixtures that represent the quality of concrete that will be used on site. The approval of mixture formulas does not exempt THE CONTRACTOR from the responsibility to prepare and lay concrete in compliance with specified norms or to comply with the results demanded.

Concrete Strength Test

Samples supplied by THE CONTRACTOR will be submitted to compression tests and will be done by an approved laboratory for the following purpose: To evaluate the quality of the concrete mixtures designed by the contractor, to approve them or indicate the required modifications. Tests for these evaluations will be done on 12 standard test cylinders in accordance with the requirements of norm ASTM C-31. Those tests will be done for each mixture that is submitted for approval. Cylinder will be tested on days 7 and 28. If the contractor desires, some formulations may be tested at 45 days of curing. For this THE CONTRACTOR must supply 6 standard cylinders for the test, similar to the ones described before, for each 20 cubic meters of each class of concrete set at the construction site or by the volume each class of concrete set in each structure daily if this volume is less than 20 cubic meters. The concrete work will be paid--50% with the acceptance results of 7 day samples and the rest 50% with acceptance results of the 28 day samples.

Proportions of concrete mixtures

Composition

THE CONTRACTOR shall supply all the materials required for making concrete. No change shall be made regarding source of materials or their characteristics without previous written authorization. The characteristics of the materials (aggregates, water, cement, and additives) that are used in making the mixtures must meet minimum requirements established in NSR-10 particularly numeral C-4.

Resistance

Resistance criteria for the concrete at 28 days will be based on the norms for earthquake resistant constructions NSR-10, chapter C-5.

Consistency

The amount of water that is used in the concrete must be the minimum necessary so the concrete can be easily laid in the required position and when submitted to vibration, it flows around the reinforcing steel. The quantity of free water that is added to the mixture will be regulated by THE CONTRACTOR, in order to compensate for any variation in the humidity content of the aggregates when they are combined in the mixer.

In no case may the specified water/cement ratio be modified or increased. The addition of water once the concrete has started to harden to facilitate its pour will be not allowed. This hardened concrete must not be used in any other part of the construction and must be removed and transported to the approved disposal area, by THE CONTRACTOR at his own cost. The consistency of the concrete will be determined by means of a setting test in accordance with the requirements in norm ASTM C-143. The slump of the concrete that comes out of the mixer must not exceed seven and a half centimeters except for pumped concrete for which a slump of up to ten centimeters will be allowed. The maximum water/cement ratio permissible for making concrete will be 0.57 and 0.45 for tanks.

Setting of concrete

The setting time will be established in accordance with norm ASTM C-403 registers.

Sample and testing

Concrete will not be considered of uniform composition and consistency and acceptable unless the test results done on two samples taken from the times corresponding to $\frac{1}{4}$ y $\frac{3}{4}$ of the batch at the moment that it comes out of the mixer are within the following limits: The unitary weight of the concrete from each sample cannot vary by more than 0.8% in the average mortar weight of the two samples. The percentage in weight of the aggregate retained in the No. 4 mesh, for each sample, cannot vary by more than 5% in reference to the average percentage in aggregate weight of the two samples. The difference in the setting of the samples cannot exceed 2.5 cm.

3.1.2 Forms

THE CONTRACTOR shall supply and install all the necessary forms to confine and give form to concrete in accordance with the directions given in the drawings. Forms must be installed and maintained within the design specifications in order to ensure that the concrete would remain within these specifications. Concrete that does not conform to specifications must be corrected or demolished and replaced by THE CONTRACTOR at his own cost.

Forms and scaffolds must be strong enough to support all the loads that they must handle, including seismic loads and the stresses caused by the delivery of concrete. All forms and scaffolds must be sealed well enough to contain the mortar. These forms and scaffold must remain must be sturdy enough to contain the concrete from the time it is poured until it has hardened enough to sustain itself. Forms will be built so that the surfaces of the finished concrete are uniform in texture and color and in accordance with the specified finished type.

Baring specifications to the contrary, bevels of 2.5 x 2.5 cm will be put in the corners of the forms, with the objective being to get the best bevel borders on the permanently exposed surfaces. The angles and internal borders of these surfaces will not require bevels unless these are required in the drawings.

When concrete surfaces are going to receive finishes F2, the forms must be aligned so that the marks of the joints are aligned horizontally and vertically. Forms that are used for each of the surfaces that are going to receive the above mentioned finish must be of the same type.

3.1.2.1 Overhead forms

THE CONTRACTOR must use forms for concrete surfaces with slopes of over 15° in reference to the horizontal. For surfaces with slopes of between 15° and 30°, the forms shall be pre-manufactured for easy removal. Once concrete has hardened enough that it can support its own weight without deforming, the forms will be removed and finishes that are specified for surfaces with out forms will be removed.

3.1.3 Joints in the concrete

Concrete construction joints and expansion joints shall be of the types and at locations indicated in the drawings. THE CONTRACTOR must not introduce additional joints or modify the design or the location of joints shown and approved on drawings. On exposed surfaces, the joints will be horizontal or vertical, straight and continuous, unless otherwise indicated. The concrete on the surfaces of the joints must remain intact during the first days after its installation and passage of equipment over new concrete will not be allowed until the concrete has cured sufficiently to bear the stress without damage. Keys will be left in the joints in accordance with drawings. Cold joints will not be allowed in any case. Should the continuous pour be interrupted for whatever reason, THE CONTRACTOR must consolidate concrete while it is in its plastic state and form a surface with uniform and stable inclination. If operations are not started again within one hour after interruption, the concrete pouring must be stopped, until the concrete has set enough so its surface can become in a construction joint. Before re-starting mixture pouring, concrete surface must be prepared and treated. PVC Seals as well as sealing and filling materials used in the joints must meet with all requirements.

3.1.3.1 Construction Joints

Construction joints are surfaces, on or against which, concrete is going to be poured and set and to which new concrete must adhere when it has reached a degree of rigidity such that the new concrete cannot bond monolithically to the old concrete. The joints may have the PVC Seal, with or without key, as indicated in the drawings. Before pouring new concrete on or against a construction joint, the joint surface must be cleaned and treated in accordance with the specification below.

3.1.3.2 Treatment of construction joints

Prior to pouring fresh concrete over hardened concrete a layer of epoxy adherent must be spread on the surface of the joint thoroughly to guarantee the structural union of the area.

3.1.3.3 Horizontal joints

Horizontal construction joints that have open and accessible surfaces must be prepared to receive the next pouring by means of streams of wet sand or cut with a stream of pressurized air/water (green cut) as specified below. If the surface of the joint is congested with reinforcement or is not accessible, it is recommended that

this surface not be disturbed before obtaining the final setting, green cut will not be allowed and a treatment with a stream of wet sand will be the only option. The use of superficial setting retardant will not be allowed.

3.1.3.4 Vertical joints

Vertical construction joints must be cleaned with a stream of wet sand.

3.1.3.5 Contraction joints

Construction joints can be formed inducing a fissure with the objective of reducing the concrete section in that place. Such joints are to be sealed using water seals and joint compound material as per manufacturer's directions. Special precautions must be taken so debris cannot get in the joint. The transfer of loads through the joint can be guaranteed and it will be done by means of pins in accordance with construction drawings. The contraction joints shown in drawings will be constructed using a form to hold the poured concrete and removing it when set. This is repeated with another form immediately adjacent with no separation between the set and fresh cement to make the joint. Unless contraction joints are going to be injected with weak slurry, the surface of the concrete on one of the sides of the joint must be coated with a substance that will not adhere before placing concrete in the adjacent side of the joint.

3.1.3.6 Joint seals

THE CONTRACTOR will supply and install polyvinyl seals in the couplings of concrete structures, as indicated in the drawings. Polyvinyl seals of quality and design similar to the manufactured by MBT or equivalent will be used.

In the joints of adjacent tiles, the contraction joints must be treated with foam Frontier Sellalon 3/8 and a seal of polyurethane improved with asphalt sonomeric 1 or its equivalent, which must be placed in accordance with the manufacturer's recommendations.

3.1.4 Concrete placement

The pouring of concrete must be done only in certain specific places, previously approved. Concrete will not be poured during rain except when approved, in which case the permit will be given only when THE CONTRACTOR supplies adequate covers for the protection of concrete during the placement and until the concrete has set. Concrete will be poured as close as possible to its final position and it should be forced to flow by vibration. Methods and equipment used for its pour must allow good control of the concrete pour to avoid separation and splashing caused by falling from too great a height or hits a frame or reinforcement.

Concrete free falling from higher than 1.5 meters will not be allowed. Unless otherwise specified, concrete must be poured in continuous horizontal layers the depth of which shall not exceed 0.5 meters: Thinner pour layers can be demanded when necessary, if it is advantageous for the job at hand.

Each concrete layer must consolidate until the highest possible density is achieved. It must be without holes or cavities caused by coarse aggregate and must completely fill all molded spaces and adhere completely to the surface of the molds and forms. No new concrete layers will be poured until those already poured have consolidated to specification. Neither should it be poured after the already poured cement has begun to set in order to avoid damaging the recently poured concrete and the formation of cold joints.

THE CONTRACTOR must take special care to ensure that re bar ends not be jostled or repositioned for at least 24 hour after the concrete has been poured.

3.1.5 Consolidation of concrete

The concrete will be consolidated by means of vibration until reaching the highest density possible in order to remain free of the cavities produced by particles of coarse aggregate or air bubbles, and to completely cover surfaces of the forms and materials in it. During the consolidation of each layer of concrete, the vibrator must be operated at regular and frequent intervals and in near vertical position. The head of the vibrator must penetrate deeply inside the concrete to vibrate again subsurface layers.

The top layer of each pour must be vibrated again in a systematically so the concrete maintains its plasticity.

No new layers should be placed on concrete until the existing layers already poured have been properly worked. Special care must be taken so that the vibrator head does not come in contact with the forms or re-bar in it to avoid damage and displacement of them. Concrete consolidation must be done with an electric or pneumatic immersion vibrator that has enough power and capacity to consolidate concrete rapidly and effectively. Immersion vibrators must be operated at velocities of 7,000 R.P.M. In order to ensure that no time is lost due to break down it is required that the contractor have two additional vibrators at the job site when concrete is being worked.

3.1.6 Removal of forms

The forms are removed in most cases as soon as the concrete has cured enough to bear ordinary stress to avoid any damage that might be caused if left in the forms too long. In any case the time for removal will be less than that established in ACI 347 (Sec. 3.7.2.3).

The forms must be removed in such way that there will be no breakings, rippings or scratching or any other damage to the concrete. If it is necessary to coin loosen forms, it must be done with wooden pieces. The forms and the supporting works will be removed only when the concrete gets enough resistance to bear its own weight and the weight of any other load, it must be done only if such operation doesn't cause any harm to the concrete.

To avoid excessive stress to the concrete due to forms expansion or deformation, the wooden forms for the wall voids must be removed as soon as possible, at the moment when such operation doesn't cause any harm to the concrete. In order to get this purpose the forms must be built in a special way.

3.1.7 Curing concrete

Unless specified to the contrary, the concrete must be cured by keeping the surface wet at all times, water curing should be done, for at least 14 days after the concrete was poured or until the surface is covered with more concrete. Alternative methods could be approved, but in any case curing membranes will be allowed on surfaces with U3 or F4 finishes. However, they will not be allowed on the surfaces of construction joints, or surfaces that will be painted or plastered.

Should the contractor wish to use an alternate method, he must give 15 days' notice prior to using it. The equipment and materials used to cure the concrete must be available at the location where the concrete will be poured.

3.1.8 General Tolerances

Except when otherwise specified, tolerances for all structures will be as follows:

Table 1: Tolerances for concrete structures

Location			Length	Tolerance
(1)	Variation to the lineal contour, built in reference to the position established in the plan drawing	In	3 m	5 mm
		In	6 m	10 mm
		In	12 m or more	20 mm
(2)	Variations in reference to the vertical, to the slope drawings and to curved surfaces of structures including lines, wall surfaces and vertical joints	In	3 m	5 mm
		In	6 m	10 mm
		In	12 m or more	20 mm
(3)	The same as numeral 2 but for surfaces that will be in contact with fill	In	3 m	25 mm
		In	6 m	40 mm
		In	12 m or more	75 mm
(4)	Variations in reference to the levels and slopes indicated in the drawings	In	3 m	5 mm
		In	10 m	15 mm
(5)	The same as numeral 4 but for surfaces that will be in contact with fill	In	3 m	10 mm
		In	10 m	30 mm
(6)	Variations in the dimensions of the transversal sections of columns, beams, etc.			5 mm +15 mm
(7)	Deviations in the required height of floor slabs, walls etc.			5 mm + 15 mm
(8)	Variation in the dimension of stair steps, Vertical Horizontal			5 mm ± 10 mm
(9)	Difference of alignment between concrete surfaces and embedded parts			1.5 mm

3.1.9 Finishes

Unless otherwise indicated, finished surfaces must be smooth, solid, free from flakes depressions, holes, stains, or any other defect or irregularity, and must also meet all established requirements for the corresponding finish which is specified in this section or indicated in the drawings.

3.1.9.1 Finish for non exposed concrete

This refers to form surfaces next to fill areas. For surfaces that are not visible, no special treatment is required after the forms are removed, except the repair of defective concrete and fill-in of anchor holes.

3.1.9.2 Finish for exposed concrete

For those exposed to public view and for which appearance and exterior texture is of special importance a finish will be applied. After the anchor holes and surface imperfections have been repaired, the surfaces treated with these finishes must be of uniform appearance and texture. Superficial irregularities should not exceed 3 mm for soft irregularities and 5 mm for rough irregularities. Rough irregularities will not be permitted in construction joints. Besides the repair of defective concrete and the removal off imperfections and irregularities, this finish work, if considered necessary may include the use of jute cloth scrubbing to fill-in air pockets.

3.1.10 Finish for surfaces where no forms are used

The finishes of non-form surfaces are designated by SU1 and SU2, as is specified later. The non-form surfaces that are not designated by one of these symbols do not require further treatment beyond consolidation to regular lines to obtain adequate drainage according to the specifications.

3.1.10.1 Finish SU1 (leveling ruler)

This finish is applied to non-form surfaces that will be covered with other materials, or where a non-uniform surface is required. The superficial irregularities should not exceed 10 millimeters.

3.1.10.2 Finish SU2 (metallic comb)

This applies to the exposed surfaces of sidewalks. The proper operations in this kind of finish consists of making the surfaces level and uniform, where irregularities must not be greater than 5 millimeters, like the leveling of a wood trowel. The leveling should start as soon as the surface is hardened enough and continue until the surface is free of ruler marks and uniform in color and texture. After that, a comb with rigid tungsten needles that are 4mm diameter and 4mm length separated 20mm is to be passed through the surface at 90 degrees following the slope direction. This procedure leaves a micro channel texture that has to be uniform in depth and thick without obstructions at the end of the slab.

3.1.11 Repair of defective or deteriorated concrete

THE repair, removal and replacement of deteriorated or defective, fissured or broken concrete shall be at the cost of the CONTRACTOR who will be held financially responsible for the quality of the concrete work. Any defective, damaged, broken or cracked concrete must be repaired to finish quality using methods as set out in the latest edition of "U.S. Bureau of Reclamation Concrete Manual" and the repair must be done by qualified workers.

In case the concrete repairs require the injection of cement slurry or epoxy products, THE CONTRACTOR will carry out these repairs.

Unless a waiver is granted, concrete repairs must be done within 72 hours after the forms have been removed, but no repairs should be done before an inspection of the proposed repairs take place on location.

3.1.12 Repair procedure

All defective or damaged concrete must be removed. Where defective material is removed, an additional 3cm of material shall be taken from the adjacent areas to roughen the surfaces and improve adherence of repair materials.

Holes caused by the removal of piping, joints and other items, must be widened with a dented scarifier and cleaned using a sand blaster, and moistened before the repair fill. Mixtures for repair fill will be preapproved and be formulated to maximize strength, density and adherence. Places where these repairs are on exposed concrete, the replacement material must match the color of the adjacent concrete. THE CONTRACTOR must supply white cement in adequate quantity so when mixed with normally used concrete, the finish in color and appearance will be similar to the adjacent concrete. Additives that reduce contraction must be used.

In places where tie rods of forms go all the way through concrete sections of any structure that requires water proofing, THE CONTRACTOR must remove the rods and patch the resulting holes with Epoxy Resins.

Repairs and applications with Epoxy Resins and acrylic mortar must be done in accordance with manufacturer's recommendations.

Surface irregularities (roughness, bumps, etc) must be reduced or removed with a grinder to the point where the surfaces meet specified limits.

THE CONTRACTOR will supply all necessary labor, equipment additives and materials for required concrete repairs.

3.1.12.1 Materials for concrete repair

Defective concrete, as well as excessive surface irregularities must be demolished and rebuilt adequately. Defective concrete will be removed from site and replaced with dry packed fill, concrete, mortar, acrylic mortar or epoxy resins.

In general, these materials will be used in the following way:

Drypack

Dry fill will be used to fill holes that are smaller in diameter than their depth such as holes for screw heads, small fissures for the repairs of cracks, and holes left by small tubes. This dry fill should not be used for fill shallow depressions in back of reinforcement or fill holes that go totally across a concrete section.

Concrete

Must be used to fill or plug holes that go totally across concrete sections without finding reinforcement, where the area of these holes is greater than 0.1 meters square and their depth greater than 10.0 centimeters. It will be also used for holes in reinforced areas, which have an area is greater than 0.05 square meters and the depth of which extends beyond the reinforcing. Holes which have an area less than 0.05 square meters and extended farther beyond reinforcement/ rebar must be widened to make insertion of the concrete fill easier.

Mortar

Will be used to fill holes that are too wide for the use of dry fill (Dry pack) and too shallow for the use of concrete fill and for shallow depressions that do not reach the rebar.

Acrylic Mortar

Will be used when thin layers are required on inclined or vertical surfaces to fill cracks, for which finishes F3 and F4 have been specified and for surfaces exposed to water movement.

Epoxy Resins

Will be used when thin layers are required on surfaces where F3 and F4 finishes have been specified.

3.1.13 Concrete structural parts

3.1.13.1 Floor slabs for side walks

Description

This refers to the solid floor slab that is 10 cm thick made of 21 MPA (3000 PSI) concrete with a A/C=0.55 relation; reinforced with electro-welded mesh and built according to the specifications in the structural plans and the resistance indicated on them. This concrete must be of excellent quality and must be cast following the conventional methods for setting up, compacting and finishing.

3.1.13.2 Footings

Description

This must be poured on site in accordance with the dimensions and specifications indicated on the structural plans. The concrete for the blocks/spot footings will be 21 MPA concrete (3.000 psi). The dimensions and steel rebars will be used in accordance with the structural plans.

3.1.13.3 Foundation Beams

Description

The foundation beams must be poured on site in accordance with the dimensions and specifications indicated on the structural plans. The concrete for foundation beams will be 21 MPA concrete (3.000 psi). The dimensions and steel rebars will be used in accordance with the structural plans.

3.1.13.4 Subfloor slab

Description

This refers to the solid subfloor slab that is 10 centimeters in thickness, 21 MPA (3.000 p.s.i.) concrete with an A/C = 0.55 relation reinforced with welded steel wire mesh and built in compliance with the specifications and resistance indicated on the structural plans

3.1.13.5 Voided floor slab

This item refers to the construction of slabs lightened by bamboo (Guadua Type) molds, synthetic canvas, or Styrofoam and assembled in two directions, which forms the floor between stories of the building. It includes the supply and construction of all the parts it is made up of including joists, beams, edge beams, struts, and all the parts shown in plans.

It will be made of 21 Mpa (3000 psi) concrete and the dimensions of the voids must comply with the dimensions in the plans.

The upper slab must have electro welded mesh according to the plans.

3.1.13.6 Columns

Description

Columns must be poured in place in accordance with the dimension and specifications in the structural drawings. The concrete for making the columns will have the resistance indicated in the plans (21 Mpa) (3.000 PSI). Reinforcing steel bars and dimensions must comply with the structural drawings.

3.2 STEEL

3.2.1 Reinforcing steel/rebars

Materials

Reinforced steel bars will meet what is established in section C.3.5 of norm NSR 10 or the one current during construction. In general, corrugated steel bars with a minimum fluency limit of 420 MPa (grade AH42 INCONTEC) will be used which comply with what is specified in norm NTC – 2289 ICONTEC or in A 706 of ASTM as indicated in the drawings. Smooth or corrugated steel bars with a minimum fluency limit of 240 MPa (grade AH 24 of INCONTEC) may be used only for special cases when they appear in the plans or when authorized. This type of steel will meet specifications in NTC – 161 norms for smooth bars. The specific type of steel to be used in each of the structures is indicated on the drawings.

THE CONTRACTOR will supply at least 15 days in advance of the starting date for concrete work and while it is ongoing, certified tests and trial results for the resistance of the reinforcing steel that the contractor plans to use so its compliance with established norms can be judge.

In the case that any portion of the bracing does not comply with norms, it will be rejected and the contractor will proceed to replace it. The electro welded mesh for concrete reinforcement must meet the requirements established in norms ASTM A 82 and A 185 and norm 1925 ICONTEC. The bracing must be made up of parts that are highly resistance, heat laminated and cold-drawn, with a guaranteed resistance to rupture of 525 Mpa (5.250 kg/cm²) in traction tests; spaces between rods and their diameter must correspond with those commercially specified for the mesh type indicated on the drawings.

Tests

Reinforcing rods and the electro-welded mesh must be subject to tests at the factory in accordance with of the ASTM norms, latest version.

THE CONTRACTOR must supply copies of certified reports of chemical analysis and physical tests done by manufacturer, and effort curves – deformation for each lot where the materials come from. A complete description of the specified norms followed in doing the tests must be included in the reports.

Supply, manufacturing and storage

Rods and mesh must be transported and stored in an orderly manner. They should not be placed directly on the floor, and they should be duly grouped and marked in accordance with size, form and reinforcement type. Cuts on rods must be protected to prevent corrosion during storage.

Development

The reinforcement shown on the plan, the general location and the typical type of rod bending required for the job does not excuse THE CONTRACTOR from the responsibility of making charts that show the rod forms in detail. At the same time he must prepare, cut, place and distribute the reinforcement. These details must be done such that they correspond to the construction joints shown in the drawings.

Unless otherwise indicated, the dimensions shown on the drawings for the location of reinforcement will show distances up to the axes or center of rods and the dimensions shown in the de-glossing charts will indicate distances between external surfaces of the rods.

Bending Diagrams

Reinforcing rods must be bent in accordance with the established requirements in the norms regarding earthquake resistant construction NSR-10 or the version that is current during construction

In those cases where THE CONTRACTOR proposes variations in the de-glossing charts or bending diagrams supplied, these must be submitted for approval 30 days prior to the construction of any structure and the work of bending and reinforcement assemble may not start until the diagrams have been definitely approved. THE CONTRACTOR will have 15 days to object, or give the necessary instructions.

THE CONTRACTOR may not modify diameters, reinforcement spacing, lengths or positions of overlaps indicated on the plans without previous written authorization.

Configuration

Configuration will be cold-drawn, using vertical supports that guarantee interior bending diameters as indicated in drawings. When no specifications are shown in drawings, the minimum bending diameters will be used as specified in norm NSR-10 on Table C.7.1.

Installation

The reinforcement will be placed accurately as indicated on the plans and it will be firmly secured in position so that it will not be displaced during pouring and vibration of concrete. To keep the reinforcement in the correct position, guides, spacers, concrete blocks, hooks or any other attaching system may be used. These will be embedded in the concrete. They will not produce any coloration or deterioration. In each of the road crossings, an attachment system that consists of caliber 18 wrapping wire will be used to make the tie secure. If spacing is less than 0.30 m in both directions, the tie will be done alternately on each of the crossings.

When the concrete is poured, reinforcing steel will be free of lamination flakes, corrosion, oil, grease, paints, mud or any other substance or film that could reduce its adherence to concrete.

During pouring, THE CONTRACTOR cannot modify diameters, spacing, number of rods, bending, and overlaps indicated on the drawings without previous written authorization.

Overlaps and joints

The overlapping of rods and electro welded reinforcement mesh must comply with the requirements of norm NSR-10 or latest in force and this must be done at the places shown on the drawings. Overlaps must be located in accordance with concrete joints, and in a way that the use of rods longer than 9 meters is avoided. Nevertheless, where indicated in the drawings and where considered necessary, the use of 12-meter long reinforcement rods will be ordered. In that case the problems that may arise from handling rods of this length will be THE CONTRACTOR'S responsibility. THE CONTRACTOR may introduce overlaps and additional joints in places other than the ones shown on the drawings as long as these modifications are approved.

The length of the overlaps of the reinforcement rods must be those shown on the plans, however, if necessary, THE CONTRACTOR could, with previous authorization, replace the overlapped joints with welded joints. These must meet all the requirements established in section 12.15 of code ACI 318 and C.12.15 of norm NSR-10 or the latest in force as long as the additional cost of this replacement is THE CONTRACTOR'S responsibility.

3.2.2 Electro welded steel mesh

Reinforcement in electro welded mesh will be used in those places indicated on the drawings. The usage of electro welded mesh could be ordered for different structures, without causing over costs or measuring units and payment other than the ones already established in this chapter.

The mesh must be placed precisely in the places shown on the drawings and it must be firmly secured to this position during pouring and setting of concrete.

The meeting points of the mesh modules will be done in accordance with manufacturer recommendations and will be firmly tied with knotted wire by traditional methods of common usage, and in accordance with the requirements of chapter 12 code ACI 318 and norm NSR – 10.

Mesh that is covered with flakes; dust, mud, oil, paint or any other foreign material will not be accepted.

3.3 METALLIC STRUCTURES

Description

The practice of manufacturing and set-up of metallic parts will be adjusted to the latest edition of the norms regarding earthquake resistant construction norm NSR-10, included in title F. For the manufacturing and welding of parts that are considered principals, only expert and qualified personnel, correct equipment and tools will be used with prior approval.

In the event that any material or manufactured element is defective, due to the poor quality of the raw material or labor or for any other reason does not comply with specification requirements and/or drawings, the end user will have the full right to reject or demand its correction. Materials that have been rejected or that require correction will be changed or corrected at THE CONTRACTOR'S cost.

Welding

All welding that is required for the set-up and installation of the metallic elements indicated in this numeral, including equipment supply, hand labor and electrodes will be supplied by THE CONTRACTOR.

Quality Control

Quality Control for the manufacturing of all parts will be done with quality control for welding and it will be in accordance with AWS norms and with AISI ASD/LRFD codes and norm NSR-10 and job specifications.

Norms/Regulations

Unless otherwise specified, all work will be done in accordance with applicable part of the most recent editions of the norms indicated below and complemented with the particular specifications of the contract and the ones indicated on the plans.

Norms about earthquake resistant constructions NSR-10 title F.

A.I.S.C. - "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"; ASD/LRFD.

A.W.S. "American Welding Society Specifications".

A.S.T.M. "American Society for Testing and Materials".

S.S.P.C. "Steel Structures Painting Council".

ICONTEC Normas 1920, 1950, 1971 y 1985.

ANSI "American National Standard Institute".

Materials

All materials must be free of any defect or imperfections. They must be of recent manufacturing and may not be used. Their classification and grading must be approved. THE CONTRACTOR must supply, without additional cost, samples and certifications of the physical and chemical characteristics of each of the materials to be used to show that materials meet specifications.

Unless otherwise indicated, materials and their tests must comply with the requirements listed below:

Table 2: Requirements for the materials of metallic structures

Materials	Specifications
Structural steel for welded or screwed structures for dorsal beams and belts	ASTM-570 Grade 33
Screws and nuts for anchoring	A-307
Steel flanges (for support and pivot points)	A-33
Welding, electrodes E-60xx or E-70xx	D.2.0 (A.W.S.) D.1.1 (A.W.S.)

Cover Belts

This refers to the manufacturing and installation of the belts that will give support to the shingles on the roof and will satisfy the requirements of the structural drawings. Metal profiles for dorsal belts are thin cold-drawn sheets ASTM 570 Grade 33 with values of $F_y=23.2 \text{ Kg/mm}^2$, $F_u=36.6 \text{ Kg/mm}^2$ and a minimum stretch of 20% thus complying with requirements and specifications required for this job and considered in norm NSR-10.

Nevertheless, in general all qualities specified for the different materials are indicated in the respective drawings only where necessary.

The CONTRACTOR must verify that the quantity of belts shown on the drawings is the ones needed to support the shingles that will be finally used.

The supply of the metal sections must be certified by the manufacturer in reference to the quality and protection of the material from the elements.

3.4 MASONRY

3.4.1 Walls in N° 5 clay block

Description

Unless otherwise indicated, all masonry work for interior walls will be done in hollow brick of standard dimension No. 5 or their equivalent, distributed in accordance with the total levels indicated in general plans and details of the "Project" and allowing for wall thickness with their finishes. The block must be pressed and machine cut, solid, well-fired, with regular form and proper dimensions of compacted texture free of bumps, breaks, holes or any other flaws that will negatively affect its durability and resistance. In addition the block groove must be neat and uniform and have the above characteristics as well.

Development

The masonry work will be based on the general architectural plans and facade sections. Interior walls of building: classrooms, offices, bathrooms and of the logistic warehouse will have the height specified in plans.

The pre-setup of walls will be started by clearing the slab totally after which, structural axes will be rechecked, verifying their accuracy before continuing, then the interior and façade masonry will be rechecked in accordance with plans and leaving openings for door frames and windows. At the ends of each of the straight wall sections, plumb lines will be installed perfectly aligned in both directions. Over these the stake and thread will be placed in accordance with the distribution related to the facade sections. Construction of the wall will be done, once the base has been moistened, based on the side of the brick that is required in each specific area. The hydraulic, electrical as well as any other ducts will be laid while taking care not to cause more opening in fresh walls. If no additional information exists, the wall will be interlocked in rows to the half piece. Mortar will be used as specified and homogeneously spread on the areas needed. Once the lateral cement has been placed, the row will be aligned. Mortar left over will be removed. Wall faces must be perfectly vertical, and ready for the finishing. Leveling of block walls must be done over mortar fill. All elements that must be embedded must be placed in the indicated place as the wall is built as well as angles, window anchors to secure them, doors, closets, etc.

Masonry will be isolated from the structure and reinforcement and insulation details will be indicated in construction plans where masonry is not structural.

3.4.2 Solid Clay Brick

Description

This item refers to the building of parapets and platforms in solid clay bricks or their equivalent to the following dimensions: 0.245m x 0.12m x 0.06m. All of the walls will be built in uniform dimensions and edges in perfect condition with top quality material. They shall be located as specified in the general plans as well as the height, the number of rows and placement in relation to the facade sections.

The confinement structure will be built of concrete based on the structural details. The systems used for the preparation and placement of the concrete and rebar shall comply with all of the characteristics described in Chapter 4 Concrete.

Delivery, storage and handling

Building materials will be shipped in the manufacturer's wrapping and be properly identified by name, type, color and size. The materials sent as a whole will be ticketed or identified on site. Masonry materials and reinforcing steel will be stored on pallets, preferably on places that are elevated and dry. All the materials will be protected during shipping, storage, and construction against humidity, dirt and other types of contamination as well as sand and other materials of the job.

Materials

Materials with uniform texture and color will be used for each type of wall required, sent by the same manufacturer for each area that is highly visible. Masonry products are expected to be within standard size limits and are not to exceed 10mm in height in order to comply with NSR-10 norms.

Development

The setting of brick shall be based on general architectural plans. The walls indicated as load bearing walls in the architectural plans must go up to the structural level immediate above. For overlaps and low walls, the cuts and corresponding details must be located. If there are no specific indications to the contrary in the detailed drawings, the wall appearance must be in rows with beams and perfectly leveled and aligned joints to verify the continuity of the moldings to inject the mortar with the specified reinforcement in the structural plans.

Laying out

The laying out shall be initiated on the walls by totally clearing the concrete slab. The structural axis will be recovered and its accuracy will be verified before proceeding. Then the masonry will be laid out in accordance with the plans while keeping in mind the spaces for doors and windows.

3.5 WALL CEMENT COVERING (PLASTER)

3.5.1 Waterproof 1:4 Plaster

Description

These specifications concern finishing the wall with layer of waterproof mortar to provide a level surface. Waterproofing additives will be added. These will be sealant suspensions that are both organic and inorganic Sika-1 type or its equivalent.

Development

Leveling and alignment of the walls is stressed so as to prevent the waste of mortar caused by false levels and alignments of the tile. The average thickness of plaster will be kept to 1.5 cm. Vertical or horizontal variations of more than 3 mm will not be allowed for walls that are 3 meters or less in height. Plaster will be mixed in the indicated proportions to get a pliable consistency that is uniform and free of lumps depending on the type of application. Plaster will be applied directly over masonry, once the bumps and imperfections have been removed. Rooms to be plastered will already have all masonry work all of the plumbing as well as electrical and mechanical installations completed. All of the door and furniture hardware must have been installed. Guidelines will be made defining the fine alignment for the areas to be covered with cement for no more than 3 meters so that they can be filled and leveled to get straight and continuous surfaces. A mortar - sand mixture in a ratio of 1:4 will be used. Wall levels will be kept at a 90 degree angle using a carpenter's level.

Unless otherwise specified, final plastering will be smoothed with the same mixture to get a continuous, homogenous finish.

Dilatations

Dilatations of 1 x 1 cm. will be made with molds in the alignments that correspond to changes between structure and masonry and that could result in visible fissures in the plaster. Edges will be molded so that they are perfectly continuous and vertical.

3.5.2 Floor readiness. Mortar 1:4

Description

This item refers to the leveling and preparation of irregular surfaces and structural floors or floor slabs to receive floor finishes stipulated in construction plans. This specification includes waterproofing walls where ceramic tiles are used such as laundry, bathrooms, cleaning rooms and non-waterproofed mortars in all other areas walls in general and in accordance with indications in construction plans in the finishing references.

Development

The part of the job will be started once the electrical ducts or supply ducts are installed and preferably once the basic plastering is complete. The floor level will always be checked against the general levels of the slab. Care will be taken to compensate for finishes with different thickness so that the finished floor is uniform. Once the debris has been removed and the surface which is to be smoothed is completely clean and wet, horizontal guides will be placed spaced in such manner that the streams can be leveled with wood or aluminum straight edges. This shall be filled with mortar mixed with sand in a 1:3 ratio between the master levels. The surface of the base must have been previously moistened. It must have a minimum thickness of 3 cm and be horizontal, continuous, free from bumps and ready according the Embassy inspector to receive the final finish specified.

Unless otherwise indicated in the plans or specifications for the finish, the floor will be finished with a metallic trowel. This treatment will be done after the water from the mortar has evaporated from the surface or when the mortar has set.

3.5.3 Lower Closet Platform

Description

This item refers to the lower platform in the closets. They shall be built of concrete and finished in urban gray "porcelanato" or their equivalent. They shall be done as described in the general and detail plans.

Development

A concrete-mortar base shall be placed over the floor slab using spare brick pieces to reach the height of the platform and allowing for the thickness of the finish. The whole area between the walls holding the platform shall be completed as shown on detailed plans. The front side of the platform should be aligned with the front side of the walls on either side.

3.6 PLUMBING INSTALLATIONS

3.6.1 General description of activities

3.6.1.1 Supply system

The base has a drinking water supply system, it starts in a deep well where the water is pumped, then it is treated and then is pumped to a overhead tank with an estimate hight of 14 meters.

From this tank the water is distriбуted though an open system to each building in the base.

In order to guarantee she water supply for the new building it's required to compelemt the existing system with an extention of the 8" existing pipe located crossing the entrance road about 110m from the new building location.

The extention of the existing system will deliver the water in a group of tanks where a pump will provide the supply to the building.

3.6.1.2 Connection

This pertains to the pipes that draw the water from the external supply network and take it to the storage tanks. It includes tapping tee, the fittings, and cut-off valves required for the derivation. It likewise includes the meter with its fittings, valve and, box. It also includes the register before entering the tank and its floating valve.

3.6.1.3 External Supply System

The external supply system corresponds to the pipes that exit the bypass in the internal base system to pass through the storage tanks, the pumping station and reach the external wall of the building, the bathrooms or the area that contains bathroom fixtures where the valve box will be built for the closing valves.

This includes the fittings, required valves and valve box.

3.6.1.4 Main supply system

The main supply system corresponds to the pipes from the external wall of the building to the entrance of the space with the bathroom fixtures.

3.6.1.5 Hydraulic point

This corresponds to the required pipes from the entrance of the space with the bathroom fixtures to the connection point. This includes the fittings, required valves and valve box.

3.6.1.6 Supply and installation of bathroom facilities

In addition to supplying the fixtures, the required pipes shall be installed from the floor to the connection with the fixture. This includes the pipes and fittings required by the manufacturer for the installation of the bathroom fixtures.

3.6.1.7 Storage tanks

Supply and installation of the storage tanks. This includes all of the pipes and required fittings for their interconnection. It also includes the required wall bushings for the installation of the output or input for the pump. This includes the tank covers.

3.6.1.8 Pumping Station

This consists of the supply and installation of the pump and pipes required for it to operate correctly. The pipes exit the area called the pump room and connect with the supply system. It includes all of the fixtures and valves required.

It's part of this item the supply of the control board and the sensors or other devices required for the proper operation of the pumps

3.6.1.9 External sewage system

This corresponds to the section of sewers that must be built from the south-east corner of the building to the existing inspection well. Includes the building of the first inspection well and the discharge piping.

3.6.1.10 Internal sewage system

This corresponds to the pipes and fixtures from the entrance of the space containing the sanitary fixtures to its discharge in the inspection well in the sewer system section to be built. It includes the sanitary points. The sanitary points correspond to the pipes and fixtures from the connection of the sanitary fixture to the entrance of the space containing them. It includes the traps, and the air conditioning drainage system as well as the ventilation system.

3.6.1.11 Appliance installation

Includes the recommended by manufacturer piping and fittings required for the proper installation of the appliances and fixtures.

3.6.1.12 Rain water system

Includes the vertical pipes and horizontal ones that carry the run-off from the roof to the channels located on the lower levels. It includes the construction of the channels.

3.6.1.13 Filter System

This corresponds to the pipes and fixtures required for the construction of the filters located under the building's subfloor slab that discharges in the rainwater evacuation channel

3.6.2 Hydraulics Installations

3.6.2.1 External supply system

Description

The external supply system corresponds to the pipes that exit the bypass in the internal base system to pass through the storage tanks, the pumping station and reach the external wall of the building, the bathrooms or the area that contains bathroom fixtures where the valve box will be built for the closing valves.

This includes the fittings, required valves and valve box.

Development

The bottom of the excavation must be examined to remove hard objects such as rocks or anything else that could puncture pipes. No special material is necessary to fill it when the bottom is soft and fine, free of rocks and easily leveled. When rocks or other objects that in the opinion of the United States Government or its representative could puncture them are there, he could order a layer of fine granular material that is a minimum of .05m deep to be laid.

Once the pipes are installed, the trench must be filled to protect them. The material initially used to fill must be fine and could be selected from the dirt removed from the excavation. The trench must be filled with this material while compacting it carefully around the pipes until it is 0.15 m above them. Over this layer the trench can be filled in with dirt from the excavation as long as no large rocks that could affect pipes are included.

The pipe system will be built in P.V.C for pressure applications (with brand registered with ICONTEC) pipes and joints will be cemented with PVC cementing compound. Before applying the cementing compound, pipe ends and the fitting must be cleaned with cleaning solution even though surfaces appear to be clean. Cementing compound must be applied in such way that an exterior coat is left between the fitting and the pipe. The pipe must be inserted inside the fitting socket to between 1/3 and 2/3 of the length. Any application of the cementing compound must not take more than one minute to finish. After the cementing compound is applied, the pipe must be left still or static for at least 15 min and testing of that part can only be done 24 hours later.

The connections to other types of pipes must be done with the corresponding adapter.

All change direction must be done with the adequate fittings.

The changes in direction, reductions, valves and plugs where the flow generates pressure on the piping must be anchored to concrete walls while placing a polyurethane membrane between the concrete and the pipes to protect them from abrasion.

It is best for fittings to have the greatest part of their external wall in contact with concrete. However, concrete must not completely surround the pipe or fitting.

Before doing the hydraulic test, the trench must be filled in while leaving the connections exposed. If it is necessary to cover the connections, their location must be marked.

Test to be done

The coupling pipe must be tested by hydraulic test in accordance with what is indicated in the corresponding specifications.

Reference to other specifications

Hydrostatic test.

3.6.2.2 Main supply system

Description

The main supply system corresponds to the pipes from the external wall of the building to the entrance of the space with the bathroom fixtures.

Development

In this case, the main supply system will go inside walls and floors of the building. Therefore, they will be installed before the finishing work is done or if that is not possible openings must be made in walls and floor where the pipes should go and once rowel installation is complete the pipes must be covered while repairing the openings with a mortar that is equal in quality to that used for the masonry and floor.

In the installation of P.V.C pipe for pressure applications certified by ICONTEC, special care must be taken in cleaning the pipes especially those surfaces that will be connected.

In P.V.C pipe for pressure applications the unions will be made with P.V.C. cementing compound. Before applying the cementing compound, pipe ends and the fitting must be cleaned with a PVC cleaning solution even though surfaces appear to be clean. Cementing compound must be applied in such way that an exterior coat is left between the fitting and the pipe. The pipe must be inserted inside the fitting to between 1/3 and 2/3 of the length. Any application of the cementing compound must not take more than one minute to finish. After the cementing compound is applied, the pipe must be left still or static for at least 15 min and the openings may only be repaired 24 hours after the last connection is made.

Acceptable tolerances

The United States Government or its representative will accept pipe installation based on the results of checks done during construction and in accordance with specified tolerances for hydrostatic tests.

Test to be done

The internal supply piping must be tested by hydrostatic test based on what is indicated in the corresponding specifications.

3.6.2.3 Cutoff registers

Description

Cutoff registers are the locking valves that must be installed in the places indicated on the plans and that are used to isolate the entire water supply or partial zones with in order to do maintenance work. (This includes the box in the wall where the valve should go and which should be plastered and have a cover.) These are included in the above item and are independently presented in this specification to establish the construction procedures.

Development

Registers must be made of bronze and ICONTEC certified. They must be installed in the horizontal pipe from the joint made up of the two vertical branches that join in one single horizontal PVC-P pipe that should have been built previously as a part of the main or internal supply. To install the valve, the horizontal pipe should be cut to an approximate length equal to the sum of the lengths of the valve, two male and female adapters and a connector.

In P.V.C pipe for pressure applications the unions will be made with P.V.C. cementing compound. Before applying the cementing compound, pipe ends and the fitting must be cleaned with a PVC cleaning solution even though surfaces appear to be clean. Cementing compound must be applied in such way that an exterior coat is left between the fitting and the pipe. The pipe must be inserted inside the fitting to between 1/3 and 2/3 of the length. Any application of the cementing compound must not take more than one minute to finish. After the cementing compound is applied, the pipe must be left still or static for at least 15 min and the openings may only be repaired 24 hours after the last connection is made.

The connections with the register will be done by means of a nut and using Teflon tape or sealer.

Acceptable tolerances

In accordance with specified tolerances for hydrostatic test.

Test to be done

The register installation will be checked simultaneously with the hydrostatic test of the corresponding system.

Reference to other specifications

Hydrostatic test

3.6.2.4 Installation of facilities

Description

This consists of the installation the bathroom facilities in the different parts of the building. It includes pipes and fittings required for the installation of bathroom fixtures and recommended by the manufacturer. It includes putting in the faucets and fixtures for sanitary apparatus.

Development

The connections from the distribution system to the devices must be done with galvanized iron, for work pressures no less than 200 PSI. Therefore, any changes of materials must be done with an adapter that is suitable for this task. The brand pipe must have a quality certified by ICONTEC.

Joints will be done with nuts and using Teflon tape or sealant. Changes in direction must be done with fittings in galvanized iron. No bending of pipes will be accepted.

Any corroded nut must be cut for a new one to be placed. In the event that leaks are detected in any union between pipe and fitting, it must be taken apart completely and attached again using Teflon tape or sealant.

In general for installing appliances, recommendations from catalogs of manufacturers shall be followed. For devices where excessive pressure could damage seals such as toilets, sinks and showers, special care must be taken to extend connections that go up to the device, about 30 cm beyond the exit point, in order to supply a ½" air pocket which will provide protection against any jump in pressure.

Acceptable tolerances

The United States Government or its representative will accept piping installation, in accordance with check results done during construction and in accordance with specified tolerances for hydraulic tests.

3.6.2.5 Hydraulic test for supply systems

Description

A hydrostatic test is understood to be when a section of pipes or a branching pipe system is subjected to a determined level of static pressure in order to verify that there are no leaks.

Development

Two types of hydrostatic test will be identified: a) The ones applied to pipes for distributing drinking water and b) The ones done on sewage systems.

Hydrostatic test for distribution pipes:

When the distribution network for the building is finished or when a 100 m section of pipe is finished, the system must be tested by hydrostatic test. After the installation is finished, Contractor must wait 24 hours to do the test by following these steps.

- a) Open highest valves to allow air inside the pipes to escape.
- b) Fill pipes completely with water.
- c) Once the pipe is filled with water, close all open valves.
- d) Close water inlet and connect the pump to the system. It must have a register, retention valve and indicator gauge measures between 0 and 200 PSI. The test pressure should be 80 psi.
- e) Close the register completely and wait 24 hours.

The test is approved if no leaks are found. If the opposite occurs, the leaks should be located, the necessary repairs made and after a wait of at least an hour the test should be repeated.

Acceptable tolerances

INL will accept the installation of the pipes if there is no appreciable reduction in the pressure initially registered on the pumping system manometer.

3.6.2.6 Storage tank

Description

This consists of the construction of a storage tank which is made up of four 3,000 liter plastic tanks. It includes the piping and fittings required for the intake and outlet pipes. It includes the wall bushing.

3.6.2.7 Constant pressure pumping equipment (hydro pneumatic equipment)

Description

This consists of the equipment, pipe fittings and construction works required to install the constant pressure equipment that will take the water from the storage tank and carry it to the AF supply system. It includes putting it into working condition. The pump is made up of two 1/2 HP pumps ($Q_d = 1.76 \text{ l/s}$ y $11 \text{ m} < H_d < 15 \text{ m}$ each). The above specifications correspond to a 50/50 division. The hydro accumulator tank should 160 liters. In any case, this capacity should be checked by the provider of the pumping equipment (including the control panel and the maximum and minimum level controls).

Note: The specified work load corresponds to the minimum load that the equipment should carry. Therefore, a pump that carries higher loads could be selected but not one that is higher than 28 mca.

3.6.3 Toilet Installations

3.6.3.1 Sanitary Point

Description

The sanitary points correspond to the pipes and fixtures from the connection of the sanitary fixture to the entrance of the space containing them. It includes the traps, and the air conditioning drainage system as well as the ventilation system.

Developments

The pipe system will be in sanitary P.V.C pipes (ICONTEC certified) for pressures no less than 50psi. The brand of pipe must have ICONTEC quality certification.

Any change in direction must be done with the correct fittings and for every two changes in direction an inspection plug must be left.

The minimum slope for this type of pipe will be 1.5% unless other value is shown on the hydraulic plans.

The inlet of the sewage pipes must not be left open to prevent obstructions. The inlet must be plugged with "sanitary test plugs" sold on the market, which must be kept there until the sanitary and industrial devices are connected.

INL will accept pipe installation, based on the results of the checks done during the construction and in accordance with specified tolerances for the hydraulic test.

The outlet for connecting to drains, sinks, toilets, or other sanitary apparatus will be constructed based on the diameter of the horizontal pipe that drains it, and which is indicated on the plans.

Test to be done

Internal plumbing for drainage must be tested by a hydrostatic test according to the specifications of the test.

Reference to other specifications

Hydrostatic test

3.6.3.2 Ventilation system

Description

This consists of the ventilation of the building's internal sewage pipe system.

Construction Development

The system should be built of light P.V.C pipes (ICONTEC certified). After the cement has been applied, the pipe must be left still or static for at least 15 min.

Any change in direction must be done with the appropriate fittings.

As some sections of this type of system will be partially immersed in the slabs, special care must be taken to firmly attach the corresponding pipe to the casting form to prevent it from becoming loose when the concrete is poured because of its tendency to float.

In the horizontal sections, the minimum slope for this type of pipe will be 1.5% towards the closest drain so that any water that condenses on the inside of the pipe can drain out.

Materials

Pipes must be built with light PVC that is a minimum of 1.78 mm thick.

The brand of pipe must be of a quality that is ICONTEC certified.

3.6.3.3 Hydraulic test for drain pipes

Description

This refers to the hydrostatic test to be done on a section of pipes or system of pipes at a specific level of static pressure to verify that there are no leaks.

Development

The test will be done on each section of piping that makes up an independent drainage system and that come together as one unit at inspection box. In the case of “sangria” they will go to a storage place.

After the installation is finished, a 24-hour wait is required before doing the test, which consists of the following steps:

Plug the pipes at the lower end.

The pipe will be filled with water from the top end for a period of 12 hours.

During this period, leaks or lack thereof must be verified and the pipes inspected while controlling the water level at the top opening of the piping.

Acceptable tolerances

The United States Government or its representative will accept the installation of the piping if no leaks are registered during the test.

3.7 ELECTRICAL INSTALLATIONS

3.7.1 Codes and regulations

To carry out the electrical project, the contractor for these systems must follow the regulations for electrical installations specified in the National Electrical Code – norm ICONTEC 2050 latest revision and other standards applied by this institute, RETIE and the standards of the local energy company (ENERTOLIMA)

NOTE: certification of RETIE's compliance for the electrical installation and deployed products shall be requested at the end of the construction process

3.7.2 Tests and adjustments

The Contractor shall do all the adjustment tests required for correct operation of the equipment, the correction of all the identified defects and putting all the electrical and telephonic installations into service. This operation must include the supply of all the tools needed to carry out the tests and adjustments.

As the different phases of the project are finished, the Contractor shall do the following tests. The results shall be written on forms which were previously approved by the testing and data department and given to the United States Government or its representative.

The insulating resistance between phase and phase and between phase and ground shall be measured for each connection and each circuit. The results of these tests must not show values that are below the minimums demanded by the ICONTEC 2050 standard.

The Contractor must test whether or not the phase load in the panels does not give an imbalance greater than 10% with respect to the other phases. This test will be done with the entire load connected.

All the necessary required adjustments in the relays, measurers, protection devices, control devices, etc, for the equipment to operation correctly must be done by the Contractor following the manufacturers' instructions.

3.7.3 Materials

The Contractor will present the following list of materials for approval: (Including RETIE's compliance certifications for each product):

- a) Metal conduit EMT and PVC pipes.
- b) Low and medium voltage cables.
- c) Line electrical panels.
- d) Self-supported electrical panels.
- e) Automatic breakers.
- f) Devices (Switches, outlets and all other devices on the quantities table).
- g) Lamps.
- h) Air conditioners.
- i) 2.4m x 5/8" copper rods.
- j) Artificial treatment for grounding.
- k) 115g Cadwell solder.
- l) Insulated high voltage transformer
- m) Electrical plant.
- n) 12 Ms concrete posts.
- o) Hardware such as metal crosspieces.
- p) ACSR 2 cable.
- q) Retaining insulators 6".
- r) Transformer
- s) Switch disconnecter

The Contractor must obtain those instructions and those documents will be part of the specifications. The type as well as the capacity and the application of each part and material must be guaranteed for satisfactory operation for the respective uses of the electrical system.

All the equipment must be installed according to the manufacturer instructions

3.7.4 Quality of the materials

All the materials and equipment stipulated in these specifications are limited to products regularly manufactured in Colombia and recommended by the manufacturers for the intended use. RETIE certification shall be included. These materials and equipment will have the capacities and characteristics to fully comply with the specifications and requirements of the project.

To do the electrical installations, the Contractor must choose between the following brands:

Table 3: Material specifications for electrical installations

Material	Brand
Metal conduit pipes	Colmena or equivalent
Cable trays	Legrand or equivalent
PVC Coundit Pipes	Pavco, colmena or equivalent
Low and medium voltage cables	Centelsa, Procables or equivalent
Line electrical panels	Luminex or equivalent
Self-supported electrical panels	Luminex or equivalent
Automatic breakers	Luminex, Siemens or equivalent
200A Switch Disconnecter	AWA, Siemens, ABB or equivalent
Power transformers and Low-Low Insulation	Siemens, ABB or equivalent
DPS (TVSS)	Legrand or its equivalent
Connectors	3M or equivalents
Insulating tape	Scotch, 3M or their equivalent
Outlets and switches	Leviton or equivalent
Lamps	Schreder, Phillips or equivalent
Welding and rod for grounding	Cadwell or equivalent
Chemicals for grounding	Favigel or equivalent

The brands mentioned in these specifications are simply to indicate required levels of quality needed for the materials and equipment to fulfill the contract, but it is not imperative that these brands be acquired. CIDET and ICONTEC certifications must be submitted for each material proposed for the construction.

3.7.5 Pipes

Installation of these must be done according to the distribution of the electrical installation plans. All pipes cut at the place of work have to be filed to rid them of ridges and roughness that could damage the conductor insulation. The unions must be done using the connections according to the manufacturer instructions. If curves have to be made, the pipes will be curved following the instructions of the manufacturer so that the piping will not be damaged or the interior diameter be reduced. A section of pipe between two consecutive boxes must not have more curves than the equivalent of four 90° elbows.

All pipes that enter control panels and switch boxes must enter perpendicularly and in no case will arrive diagonally. Pipes will be cut so that its extremes coincide precisely with the openings in the metal on both sides. The pipe should end even with the metal plate and be secured with nuts both inside and outside.

All pipes that must be embedded will be inspected before the corresponding slab is laid in order to assure its continuity and correct location. During the building all the ends of the pipes must be closed off.

Air must be blown through the entire pipe system and be cleaned before the installation of the electrical wires.

The continuity of the grounding wire must be guaranteed.

For all the pipes that must be embedded in plates, floors and walls, no surface of pipe may be embedded at a depth of less than one (1) cm, except at the points of input to out boxes or panels.

Pipes that enter the boxes and control panels and that splice or exit should be provided with the appropriate terminals at their extremes.

The joining of all pipes must be done using appropriate unions of the same type and brand of pipe.

The minimum caliber for the metallic and PVC piping will be:

Table 4: Minimum caliber for PVC and metallic piping

Piping	Minimum caliber
Electrical pipes	Diameter 1/2"
TV. Antenna Pipes	Diameter 3/4"

These pipes must be installed according to norm NTC 2050 Section 348. The support must comply with the standard NTC 2050 Articles 348-12. PVC conduit pipes, standard ICONTEC 979.

A section of piping will not contain more than four angles (360°) from one extreme to the other, from one end to fitting or from fitting to fitting for distances of up to 15 m. and a 90° angle for distances up to 45 m. (For intermediate distances it will be calculated proportionally). These curves can be made on the job as long as the interior diameter of the pipe is not appreciably reduced.

Pipes embedded in walls, floors and slabs must be PVC or EMT according to the plans and diameters of the designs. Pipes hanging from the roof and in sight must be metallic EMT or if another specification is required, this has to be indicated on the plans.

Pipes shall have a grounding wire with or without insulation of the caliber mentioned in the notes on the plans for outlets and in the line drawing and in circuit diagrams for boxes. It must be firmly attached to all boxes, panels and devices. The grounding circuit must be continuous for the entire length of the pipe. Recommendation EIA/TIA 607 must be followed.

All the grounding lines of the pipes will be twisted together in the boxes and will be fixed with an appropriate connector to the grounding bar of the box.

Pipes overhanging the roof will be adequately attached and secured by means of galvanized devices and attachment bolts. When several pipes are over hanging, the necessary structural supports will be supplied (with spacing equal to the ones indicated in article 346-12 NTC 2050).

3.7.6 Outlet boxes

Where installations are interlocked, the boxes for lamp outlets, outlets, telephone outlets, lighting control switches will be of galvanized iron sheeting, American caliber # 20 as a minimum and not less than 2" deep.

If outlet boxes are to be put in the floor, these boxes have to be manufactured in cast iron, equipped with screws to level them and provided with openings to receive the conduit pipes to be installed.

Boxes and fittings for pipes used for installing pipes that will be in view will be metal. The installation of outlet boxes must comply with the requirements of Article 370 of the Electrical National code Standard 2050.

All the boxes for lamp outlets, outlets, devices, etc, must be large enough to provide space for all the conductors contained in the box. The lamp outlets where the pipes are embedded must be provided with a 4" x 2" octagonal box. The outlets for simple switches must be provided with a 2" x 4" x 2" rectangular box with supplement. The outlets receiving two or more pipes must have, in all cases, a squared 4"x 4"x 2" box with supplement corresponding to the type of device to use. While these boxes are being used, just the openings to be used will be perforated.

Unless otherwise indicated, boxes must be placed at the following heights, measured from the level of the floor to the box:

Table 5: Specifications of height for outlet boxes placement

Height (m)	
0.3	Outlets, voice and data.
1.1	Switches.
1.2	Outlets for voice and data over counters and sinks. TV antenna
2.0	Wall Lamps
More than 2.0	As shown on plans

All these boxes must firmly secure to their places and will stick out 1 cm. beyond the masonry, such that when the walls and ceiling are plastered, the edges of the boxes will be even with the wall.

3.7.7 Cables for lv electrical outlets, coupling

Cables and wire that are used in the installation of illumination, outlets and boxes must be red electrolytic copper, 99% pure, soft temple and have thermoplastic insulation for 600 volts type THHW 90°C.

Electrical conductor up to No. 10AWG will be a single wire if they go in piping; and several wires (cable) if they go on a tray. No. 8 AWG up to No. 2 AWG will have seven wires, from the caliber 1/0 up to No. caliber 4/0 will have nineteen wires, from 250 MCM to 500 MCM will have 37 wires.

If they are necessary, all branching or splices of the conductor wire must be done in the exit boxes or pass boxes and no case inside the pipes. Between box and box the conductive wire will be of continuous sections.

All connections in the branch boxes corresponding to the lighting system and outlets up to No. 8 AWG will be done by connectors without scotchlok brand 3M solder or its equivalent.

To connect cables with calibers greater than No. 8 AWG, the connections will be made with special jumpers.

At least 20 cm of cable must be left in all boxes to connect corresponding devices.

Cable ends that enter the panel will have enough length (half box perimeter) to allow correct branching.

To identify different circuits installed inside the same pipe or connected to the same system, it is recommended that the BT color codes be used:

Table 6: BT color codes for different circuits

Circuit	Color
Neutral	White
Continuous Grounding	Without insulation
Regulated grounding	Insulated green
Phases and switches	Yellow, blue and red. (A specific color for each phase)

Neutral or grounding conductor wire greater than No. 8 AWG must be left clearly marked at the extreme ends and in all of intermediate pass boxes with their corresponding color.

It is recommended that the branches of the regulated or protected circuit system be labeled to identify them from the general service web and isolated or not regulated. The identification requirements for the circuit in accordance with the type of service of the regulated neutrals will be met to greatly facilitate the labor of administrating and cable maintenance during the normal operation of the building.

At the same time, it is recommended that the grounding conductor wire or "insulated grounding" be differentiated using green with a yellow line for the entire length of the cable to avoid mistakes in the connection.

During the process of inserting conductor wire in the pipes, the use of oil or mineral oil as a lubricant will not be allowed.

For the installation of conductor wire inside the pipes, the pipes where water may have entered must be checked and dried. This job must be done only when it can be guaranteed that no water will enter piping later on, or over the course of the pending construction jobs, so that the conductor wire will not be damaged. When inserting the conductors into the pipes, be careful to avoid causing acute angles in the conductors.

Splicing of cables and wires will not be allowed in piping. The conductors have to be continuous from the output of the breakers in the corresponding box to the exit boxes, derivation or unions.

All the connections for unions and derivations in conductors up to and including caliber AWG #10 made in the pass boxes must be made with Scotch tape #33 or its equivalent.

The unions in conductors caliber AWG #8 and greater will be made using appropriate compression type connectors and will be covered with insulating Scotch tape #33 or its equivalent with a thickness of greater than 1 1/2 times the insulation of the conductor.

All the conductors that are caliber AWG #8 and over must end at a connector of an appropriate size and type of compression made with adequate tools.

During the change of direction for the cables, great care must be taken to ensure that the curvatures are done gently with a minimum curvature radio of 20 times the diameter of the cable.

All the cables for lighting and appliances must be fully identified inside the general panel with the specified nomenclature in the plans. For this purpose, the Contractor will present the United States Government or its representative with samples of labels in an insulating and non-combustible material for his approval.

During the installation of the cables and wires, the tension must be applied gradually and sudden strong pulls shall be avoided.

The maximum recommended tension specified by the manufacturer and as a general practice must not be exceeded for any cable. Cables must be joined to the tensioning devices in such a way that the stress is uniformly distributed.

Wiring must be of the same size throughout its length and the feeder cables for engines, panels, switches, etc., must be continuous without unions along their length.

The size of the smallest conductor allowed will be AWG #12 except when otherwise indicated.

When the Contractor must connect equipment supplied by third parties, he must completely identify all the unmarked wires in the terminals. If the wires are marked in the terminal, the same numbers must be used in the terminal at the other end.

The materials and tests for these conductors will follow the requirements of the latest revision of the American Standards ICPCEA-S-61-402.

3.7.8 Electrical circuit panels

Panels must contain automatic thermo-magnetic breakers, assembled in a unit with tetra polar bar, insulated neutral bar that is appropriate for 200 amperes and covered with a steel sheet. They will be embedded in the wall. These panels must be designed for a 4 wire, 208/120 volt, 60 Hertz 3-phase system, according to the indications on the single-wired diagrams. Breaking current/capacity I_{sc} :10kA. Insulation voltage 600 volts. IP20C IK 05 container. With door and lock.

The box must be manufactured in sheet steel of American caliber no lower than #16 and the "general use NEMA 1" must be followed while giving a finish in white. The surface of the panel must be uniform and resistant to corrosion using a phosphate process with zinc and manganese, manipulation and atmospheric agents. When selecting the supplier of panels to be installed, the Contractor must take into account the fact that the material meets the ISO 9001 standard. The breakers for the derived circuits incorporated into the previous panels must be automatic, in a molded plastic box, which can be plugged in and a mechanism for fast closing and opening as well as simultaneous action of the poles.

The circuit breakers must be provided with thermo-magnetic parts allowing an inverse time-distance reaction characteristic and instantaneous tripping with a capacity of interruption in short-circuit not less than 10,000 amperes RMS, 240 volts. The switches must be individual, interchangeable and supply the quantity and capacity of continuous load and number of poles based on the capacity of the panel including the reserve ones. The Contractor must make sure when selecting the supplier for the breakers to be installed that the material meets the following certifications: ICONTEC NTC 2116, CIDET, IEC 898.

All the boxes must be built into the walls with their sides completely even with them.

Panel wiring must be done so that it is easy to follow and leave enough length to allow the conductor to be properly connected to the automatic breakers.

At the moment the electrical installation is turned over, the Contractor must print the nomenclature of the breakers on the panel card according to the indicated nomenclature on the plans.

3.7.9 Automatic breakers

These circuit breakers will be incorporated into the above mentioned boxes. They will be automatic, with automatic tripping in a type of molded plastic box that can be plugged in. They have a mechanism for fast opening and closing and simultaneous action/work of the poles.

Manufactured in accordance with the UL 489 norm (6,000 operation cycles with load) requirements. Breaker capacity: 10 kA (120V). Width of the breaker: 19mm. Working voltage: 120V, insulation voltage 600V.

The circuit breakers must be provided with thermo-magnetic parts allowing an inverse time characteristic and instantaneous tripping. They will have an interruption capacity in short-circuit of no less than 10,000 amperes RMS. The switches must be individual, interchangeable and supply the quantity and capacity of continuous load and number of poles indicated in the panel load tables.

Molded-case or industrial circuit breaker

These are mounted in a profile frame or on a board within the electric board to guarantee the cut-off, control, isolating switches, protection for low voltage electrical lines, and the entire electrical board. Do above fixed connection. Connection terminals shall be supplied. They shall conform to the UNE-EN 60947-2 norm.

3.7.10 Motrice force panels

Panels for motrice force distribution will be apt for general use, of overlapping assembly and self-supported with a three-phase 208/120 volts, 60-Hertz operating system and industrial type automatic breakers.

These panels must be completely assembled at the factory and designed so that all the automatic breakers can be replaced without disturbing the adjacent units and without disconnecting the other derivations from the main bar.

The construction of the housing will meet the NEMA 1 Standard for general use. It will be manufactured in sheet steel and be of sufficient size to provide 5" of space as a minimum on each side for the wiring.

It will have a hinged door that covers all the breaker handles and no live parts will be exposed when opened. The door must include a lock.

The bar system will be located in between the columns of automatic breakers, feeding into them from the sides through derivations made from electrolytic copper flat bar for current densities no higher than 1000 amperes per square inch of transverse section at the total load. No part may exceed an ambient temperature of 40°C.

Bars will be supported by means of fiber that has high electrolytic power and low hygroscopicity. Their construction must provide the necessary thermal and mechanic characteristics to enable them to endure currents that cause short-circuits indicated in the line drawing without suffering damage.

Derivations or extensions of the bars that feed each switch must be manufactured in of electrolytic copper bar.

A continuous grounding bar, which is 50% of the size of the main bar, must be installed inside covering the entire front of the panel and will have appropriate terminals to receive a naked copper AWG 2/0 cable and containing additional terminals to shunt as much of the cable as needed for grounding.

3.7.11 Light switches

All switches must meet the latest update for standard NTC 1337 (Switches for fixed electric domestic installations and such like).

Simple switches will be embedded type, appropriate for AC installations, with a capacity of 6 amp. 250 volts of maintained contact, two positions (opened and closed) with screw terminals appropriate to receive No. 12 and No. 14 AWG caliber copper wire, with fixtures, screws and interior flange.

If they are for the outdoors, they must be weather resistant.

They will never be connected to the neutral wire.

Double, triple, commutable, double commutable and 4 way switches must have characteristics similar to those mentioned above and comply with article NTC 380 – 14.

Switches will be Lumina Kora line or equivalent.

When placed vertically, the switches must turn on in the up position and turn off in the down position. When they are placed horizontally, they must turn on to the right and turn off to the left. Switches are part of the light outlets.

3.7.12 Outlets

All the outlets will meet NTC 1650 standard third updating (outlets for general domestic use).

External outlets will have a cover that is appropriate for those that are exposed to the weather. Any outlet located within a wet zone will be GFCI in type.

Outlets for general use will be double, grounding pole, with a capacity of 15 amperes at 250 volts with screw terminals appropriate for receiving AWG #10, 12 and 14 cables, with fixtures, screws and flange. They will be installed horizontally. They will be Leviton, Legrand or the equivalent.

The outlets for stoves must be tri-phase with three poles, 20 amperes, 250 volts provided with terminals with screws that make it possible to receive cables with calibers of up to AWG #10.

3.7.13 Inspection boxes

The electric inspection boxes must have the sizes according to each regulation. The lid must extend at least 50 mm out over the surrounding ground if the box is built on the ground. The lid must be in concrete with a handle and a metallic frame. The upper part of the box must also have a metallic frame made up of iron bands in which the lid fits properly. This item includes the work involved in moving the dirt. The electric pass box must be built on top of a layer of 2,000 psi/ light 30mm concrete base, a reinforced concrete slab as a bottom (100mm thick and N° 3 rods and 150mm in both directions). The walls must be made of solid firebrick and plastered with 1:4 waterproof mortar and the interior walls plastered with 1:3 waterproof Sika 1 mortar or its equivalent.

The pass boxes will be located as shown in E-5. They must be at the same level as the sidewalk.

The inspection boxes will be built using firebrick with plaster on the inside. The interior cement between the bricks and the plaster will have a 1:3 mixture.

The box frames will be made of iron in the form of an angle, 2 ½" x 2 ½" x ¼" in dimension and nationally manufactured. The flat, thin, longish iron bar platen forming the covers must be 2" x ½" x ¼" in dimension.

Concrete

The concrete for the inspection boxes, embedding pipes, etc, must meet the ENERTOLIMA regulations.

Reinforcement steel

The reinforcing steel/rebars must meet the ENERTOLIMA regulations.

3.7.14 Technical standards for doing the work

Code

The Contractor of these systems must follow the 2050 ICONTEC standard (National Electric Code), RETIE and all the recommendations made by CODENSA for doing the work.

The outlet installation must follow the requirements of Article 370 of the National Electric Code, norm 2050.

3.7.15 Low voltage work (LV)

3.7.15.1 Wiring in LV

The main electrical cable in LV is will be connected to the transference and will go directly to the current substation general services panel made up of a 5 m circuit with an adjustable 3x650A, industrial breaker at each end.

The first connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3x80A TG 1-1 industrial breaker.

The second connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3x80A TG 1-2 industrial breaker. About 50ML

The third connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TG 2-1 industrial breaker. About 25ML

The fourth connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TG 2-2 industrial breaker. About 55ML

The fifth connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TAA 1-12 industrial breaker. About 20ML

The sixth connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TAA 1-2 industrial breaker. About 50ML

The seventh connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TAA 2-1 industrial breaker. About 25ML

The eighth connection exits the main board in an AWG THHN/THWN-2 3X4 + 1X6 +8T bare copper conductor with an adjustable 3X80A TAA 2-2 industrial breaker. About 55ML

The ninth connection exits the main board in an AWG THHN/THWN-2 3X8 + 1X10+ 10T bare copper conductor with an adjustable 3X50A T Pressure Equipment industrial breaker. About 40ML

The industrial breakers may only receive one conductor. If more than one conductor is used per line, a distribution mechanism must be installed in order to avoid connecting more than one conductor at a single opening. If this requirement is not met the work will not be accepted.

3.7.15.2 General electric Panel

The main electrical cable going out from the new 150KVA pedestal type transformer must be connected to the IP65 transference which must have its bars, industrial breakers and protections. The 208/120V AC general panel must be made up of a 3X400 tripolar, Eight (8) 3x80A and one 3X50A adjustable totalizers for the general services distribution panel. It will be connected to the through connection of the system so that it provides the flow of electricity. Its characteristics should be suitable for installation in humid environments and exposed to the weather.

The industrial breakers and protections will be equal or equivalent to Merlin Gerin, ABB, Siemens, Legrand or equivalent brand. They will have a digital indicator for voltage and current that is PM 810 or equivalent. The panel will go in the electrical room as indicated on plan 75-EPG-1. It will go in a metallic unit. The panel must meet the UL60 or NTC 3471 norms with respect to its construction and distribution. The panel must be labeled and contain a single-line diagrams and directories. All of the switches installed inside the panel will be labeled with a plastic label in bas-relief with white for letters on a black background.

The busbars of the panel must be wrapped in tape in accordance with the color code that should be followed exactly as indicated here: yellow, blue and red for phase conductors, white or natural gray for neutral and green or bare wire for grounding. The color code in BT applies to this project from the connection point to the busbars in the general panel.

3.7.15.3 DPS

The bidder should include in the estimate the installation of a device for protection against transitory over tension (DPS) class A in type, that complies with the ANSI/IEEE C62.45, IEC 61643-1, filtrate EMI/RFI norm, means of protection: L-L, L-T, L-N, N-T. The DPS should be installed at the main electric panel.

Maximum Voltage:

L-L:800,L-T:400,L-N: 400,N-T: 400

Maximum transitory current: 200KA +- 50 KA T-N

Normal Voltage 120/208 Vac WYE, 3F

ClassC= wave lightening crash current (10/350 μ s) limp en KA.minimum de 25 kA wave (10/350 μ s) per pole.

3.7.15.4 Distribution BT panels TG, T-AA, T-BOM

The Contractor shall supply and install FOUR distribution panels, in order to connect the general purpose services. Also two panels, **TAA** and **TBOM** will be provided with the related systems. Each box will have a tripolar industrial breaker: as shown in the load tables on the 75-EDG-602 plans. Three of the distribution panel shall have the capacity for 24 circuits respectively and one, the capacity for 30 circuits. The distribution of the load will be done based on the load tables on plan E-7. The distribution panels and all of them must have the same building characteristics as the general box thus meeting the NTC 3471 and UL60 norms. The boxes will be bolted to the wall.

3.7.15.5 Illumination

The Contractor must install the lighting system which is presented on plan 75-E-5, 6. The height of the lights must have the same distance to the ceiling. Lights will be 2 x 32 Phillips or Sylvania hermetic lamps, or their equivalent, 120V electronic and quick ignition ballast, for better onsite maintenance due to the availability of spare parts;

- Phillips or Sylvania embedded cone lamp or its equivalent that is 15 cm in diameter with a 2X26W reflective interior.
- Phillips 110v fluorescent lamp or its equivalent.
- 20cm wall-mounted tortoise 20w light-fixture with a protector mesh made by Phillips or Sylvania.
- 50w 110v fluorescent tobacco type lamp.

The contractor must make an estimate of the connection for each lamp without using the rubber cable as a result of which each branch of the circuit must end at a grounded double outlet. The conductors will go from the ballast to the outlet using flexible armor (American armor) and end with its corresponding pin so that the lamp can be removed for maintenance or fixing. It's recommended that each double outlet might be used to supply two lamps only when they are controlled by the same switch. Each outlet must be double and grounded and must have a label indicating the circuit number. For the inlaid turtle type lamps the outlet must not be installed

3.7.15.6 Installation of the grounding system

The project also includes the installation of the grounding system. The system is required to have an impedance of less than 5 ohms. The contractor must do a study of the soil to determine solutions and adjustments for the land in order to improve its resistance. The equipotential bar which is installed for the project must receive the grounding lines radials. Each grounding line must be labeled to indicate where it comes from and what it is grounding. The label cannot be made of tape or contact paper. It must be made of a resistant plastic with an orange background and red letters. The Contractor must supply and install the 30x30x60 cm boxes with metallic lids in order to inspect the grounding electrodes. The trenches for the naked grounding conductors will be 50cm below the ground level. The Contractor must use the correct equipment in order to certify the grounding system and indicate the results of the variables, as shown in the item for the substation for grounding. The 4" x 1/4" x 10", 99% copper equipotential bar to be installed by the Contractor in the building must be connected to the substation bar and to the grounding system.

The resistance of the grounding system shall be measured with the appropriate equipment. If this test gives a result greater than 5 ohms, the Contractor shall install additional electrodes until the resistance is less than 5 ohms.

After installed the grounding system and before energizing it, it must be measured. In the event that the system has a resistance that is above 5 ohms, it will be necessary to reinforce the mesh by placing an electrode at every vertex/corner of the square and a meter apart (underground). The system must take an equipotential grounding barrage with a minimum of 300 mm X 100 mm in copper that can go into the interior of the cell of the general box or outside in electrical box for inclement weather. The correct treatment will also be applied at every site where there is a new electrode in order to reduce the resistance of the area. The grounding system must be certified based on the following criteria:

- a) Official Value of the resistance according to norm IEE 142-4.1.2.
- b) Material of the electrodes according to NEC 250-52-c (2).
- c) Size of the electrode rod NEC 250-52-c (3).
- d) Separation between (among) electrodes NEC 250-56.
- e) Quality connections NEC 250-70.
- f) Caliber of the conductors of the mesh NEC 250-50 (d).

- g) Caliber of the grounding conductor NEC 250-66.
- h) Quality of the cables NEC 250-50.
- i) PT Interconnection NEC 250-68.
- j) Accessibility of the electrode NEC 250-68, EI/TIA 607-5.4.
- k) EI/TIA 607-5.4 Equipotential barrages.
- l) Current Circulating IEEE 1100 table 4.3.

3.7.15.7 Installation of the atmospheric protection system

This aspect must meet the requirements of NTC 4542 standards and Mines Ministry Resolution No 180398 / 2004 – Article 42. The following general requirements must be highlighted:

- a) Pick up terminals or lightning rods: Any metallic part in the building that is exposed to being hit by lightning such as TV antennas, chimneys, communication towers and any antenna or piping that extends beyond roof must be treated as a pick-up terminal.
- b) Conductors: he conductors for the lightning protection system must meet the following requirements:

Table 7: Requirements for the conductors of the lightning protection system

Height of Structure	Minimum number of Conductor paths	Minimum caliber of conductor based on the material it is made of	
		Copper	Aluminum
Less than 25 m	2	2 AWG	1/0 AWG

Each conductor must end at a Cu-Cu, 2.44 meter, 5/8" ground electrode and be separated by a minimum of 10m and always located on the external parts of the building.

The Contractor must install an atmospheric protection system made up of the following parts: 0.6m long stainless steel capturing rod tips with base (15), 8MM aluminum rod (250) approximately, supports for 8mm aluminum wires that are suitable for the structure of roof to avoid producing leaks (145) approximately equivalent to those manufactured by DEHL REF: 223040 AL. See plan 75-E-16, 17 and 75-Ed1

All the parts used in unions between bars, conductors and conductor paths going down must meet the IEEE-837 standard. The conductor paths must go through ¾" PVC pipes inside the structure. All the grounding connections and unions must be done with exothermic solder. Shirt anchorage insulators HLC HX /16" X 2 ¼" must be installed. GAR type Burndy 1626 connectors must be used to connect the cable to 1" pipe. The system is required to have an impedance value lower than 2 Ohm.

3.7.15.8 Fire detection system

The installation work must meet NFPA norms or the United States fire codes, NEC 250, ACODAL, ICONTEC depending on how it applies to each one of the necessities. The contractor must provide a fire detection system, which will contain detectors as indicated on plan E-2. The system is made up of wireless photoelectric smoke detectors which include a 9V battery with an 85 db siren that is easy to install. The estimate is for 39 detectors.

3.7.15.9 Enclosure of equipment in MT (substation)

The proponent must close off access to the medium tension electrical equipment with an enclosure in chain link fencing as is described in the “Metallic Carpentry” section.

3.7.15.10 Substation with oil PEDESTAL TYPE

Provision, assembly, connection and putting into service of 150KVA three-phase 13.2kv /208 / 127v, 60 Hertz, transformer, on refrigeration with a non-tension operation tap, dyn5 connection with overpressure valve, oil level indicator made from galvanized sheet steel properly treated against a corrosive atmosphere, made in 2012 Siemens, Abb, brands or their equivalent. The contractor must annex the test certificate. Any lost energy must be that stipulated by the ICONTEC 818 loss norm.

The contractor must provide and install a compact substation that includes an isolating switch and transformer y The isolating switch will have HH type 10A fuses of a recognized and approved brand. The unit must have an inspection entrance door plus internal lighting.

The contractor must present the unit in the city of Bogota, before it is sent to the installation site. Once on site all of the unpacking will be done after the site is cleaned. The equipment must rest at least 4 hours and not be turned on before then.

The connections and wiring of TM and BT must be made with premolded copper terminals, which must be presented for approval before being installed. They must be free of rough edges, cracks or any manufacturing defect. The cables must be fastened by means of screws made for that purpose, while taking care to provide the torque necessary for good contact and rigidity. The operation for connecting the system should be coordinated with the USA embassy representative and the staff on charge by the National Police. The construction of a base for the installation of the transformer is included within this item. The base will be made of 3000 psi concrete in compliance with the operational dimensions and specifications required for this purpose (vibration, etc.) according to the manufacturer of the transformer. The space assigned for the mesh to enclose should be made for this.

3.7.15.11 Retention structure

The contractor shall supply and install the structure in medium voltage, on the pole of the exit structure and the existing pole, for the retention of the medium voltage system.

3.7.15.12 4” MV downward conductor cable

Provision and installation of 6” galvanized pipe for medium tension cables according to ENERTOLIMA regulations.

3.7.15.13 Lightning rods

The lightning rods will be zinc oxide without “gaps,” covered with porcelain with systems of gas baffle pressure relief, automatic disconnection of grounding line, nominal 10 KA discharge current, nominal tension of up to 15KV and adapted to outdoors installation on metal crosspieces and concrete poles. The zinc oxide lightning rods without “gaps” must be accredited by CIDET to be installed. The applicable norms are the following: ICONTEC 2166 (Unloaders of on tension). IEC TC 37 WG4 (zinc oxide lightning rods.), ICONTEC 2076

(Galvanization by hot immersion for ironwork and structural supports in iron and steel). The electrical requirements for type I zinc oxide lightning rods are:

- a) Nominal tension for lightning rods: 15KV
- b) Maximum continuous tension (MCOV): 10.2KV RMS
- c) Frequency (Hertz): 60
- d) Tension supported by porcelain insulation
 - Dry up to (1) a minute: 31KV
 - Humid up to ten (10) seconds: 27 KV

3.7.15.14 Crosspieces, diagonals and fixed pole attachments

These must be in iron with a paint that offers protection from the corrosion caused by inclement weather. They must be galvanized by hot immersion according to norm ICONTEC 2617, 2076 or a similar norm and with electrolytic covering according to norm ICONTEC 2150. The parts must be free of rough or sharp edges and surfaces. The dimensions must agree with the norm. The installed pipe and its parts as well as the anchors, screws and metal bands to fasten them must be weather resistant.

3.7.16 Identification labels

The Contractor will supply and put plastic plates with black bas-relief and printed white letters of no less than one centimeter in height, on all the main equipment for distribution such as measuring center, panels and telephonic or voice and data distributors. These plates must indicate the destination for each fixture or part according to the diagrams.

- All electrical panels must have the single line diagram, load diagram and each circuit must be identified.
- The main distribution panel must be identified with a 10x5 label with white letters and black background. Secondary panels must have a similar 5x3 label.
- Each breaker in the main electric panel must have a 5x3 label.
- Solid plastic safety signs (electric risk) must be installed in every electric panel, in the electric room, emergency generator and sub-station.
- 5x3 solid plastic safety signs in the grounding lines coming out of the main distribution panel. Red letters and yellow background.
- 3x4 metallic carved label for pass boxes.
- 10x5 plastic signs with white letters and black background for each end of the main circuit.
- 10x5 plastic signs with white letters and black background for secondary circuits, the cables must have plastic ties every 1.5 meters.
- Electric outlets must indicate the panel and circuit which they belong to, as well as the corresponding voltage
- Switches must indicate the panel and circuit which they belong to.
- The faceplate must indicate the number of the corresponding port in the patch panel.

NOTE: For further information about the electrical works see attachment "ESPECIFICACIONES Y CRITERIOS GENERALES DE REDES DE ENERGIA ELECTRICA"

3.8 AIR CONDITIONING AND MECHANIC VENTILATION

Description

This document contains the designs for the projected air conditioning and mechanical ventilation systems for the LODGING BUILDING AT THE CNP AVIATION SCHOOL IN MARIQUITA TOLIMA.

For small, individual rooms that have different hours of use, such as the bedrooms on the first and second floor, individual Mini-Split, wall type air conditioning units are proposed. Each of these has one (1) interior air conditioning unit with its respective condenser unit located on the exterior part of the building.

This project is based on the following design conditions in which the external ones were taken from information supplied by the Institute for Hydrology, Meteorology and Environmental Studies--"Instituto de Hidrología, Meteorología y Estudios Ambientales" (IDEAM in Spanish) –based on information from the last few years:

EXTERIOR CONDITIONS

Dry-bulb temperature	90°F
Wet-bulb temperature	81°F
Altitude	1.623 Ft

INTERIOR CONDITIONS

Dry-bulb temperature	72°F
Wet-bulb temperature	60°F
Relative humidity	50% +/- 5%

Since official norms and codes to regulate these installations do not exist in Colombia, the following technical norms shall be adopted as pertinent:

ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers)
SMACNA (Sheet Metal and Air Conditioning Contractors National Association)

3.8.1 Mini Split type equipment

Mini Split type air conditioning equipment will be supplied and installed in brands recognized and represented in Colombia. Like LG, Samsung, York or equivalent, Technical support and supply of parts and replacements will also be provided in the site.

Interior evaporation unit:

The evaporation unit will be an attach-to-the wall type. It will operate silently with ventilators and directional flow regulator.

Remote control:

A remote control must be delivered with each unit for its operation.

Condensing unit:

A&E DESIGNS FOR A NEW LODGING BUILDING AT THE CNP AVIATION SCHOOL IN MARIQUITA TOLIMA
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The air-cooled condensing unit shall be provided where indicated on the plans (X-1, X-2) and work with R-410a coolant and operate at 220 V.

The condensing units will operate silently with a rotary type compressor. They will come with an air-condensing coil, horizontal air outflow from back outlet. The units will be specifically designed for installation outdoors.

Drainage:

The drains for the evaporating unit hall shall be installed by the CONTRACTOR in PVC pipes based on the diameters indicated at the site also indicated on the plans. These pipes will be insulated with ¾" thick "Rubatex" material or its equivalent.

Capacity:

The equipment shall comply with the following minimum characteristics:

Table 12: Minisplit equipment operating conditions

LOCATION		BEDROOMS
QUANTITY		40
REFERENCE		UAMS1 UCMS1
AIR VOLUME	CFM	350
TOTAL CAPACITY	BTU/H	12.000
VOLTAGE	V/1/60	208-230
COOLANT		410 A

3.8.2 Refrigeration pipes and fittings

3.8.2.1 Insulated copper pipes

Description:

A system of type K copper pipes will be supplied and installed where indicated on the plans along with their fittings to interconnect the condensing units and control units.

The pipes shall be sized in accordance with the capacity of the system distance and coolant to be used while taking into account the best practices for minimizing pressure drop-off, guarantee oil return and make it possible to absorb vibrations. The suction lines shall be insulated and the whole set shall be supported on rails with galvanized clamps.

Materials:

The pipes used shall be of type L copper, dehydrated and sealed, free of contaminants. The soldering shall be silver soldering equal or similar to HARRIS-5 (5% Ag) for copper to copper joints and HARRIS-15 (15% Ag) for copper to bronze joints.

Welding procedure:

Once the material is laid out and cut, a flow of nitrogen will be sent through the pipes at 2 psig to prevent internal rusting and slag during welding given the oxyacetylene or oxypropane equipment.

Leak test:

When the welding is finished, the system will be flushed with nitrogen and closed to test for leaks at up to 300 psig by means of a mixture of nitrogen and coolant. At that time, it shall be inspected with an electronic leak detector that is sensitive to coolant, with water-soap or other reliable methods. Once finished and the leaks found have been repaired, the test will be done again and it will be left at 150 psig for a minimum of 12 hours. The pipes may be left pressurized up to the moment they are emptied and the system is loaded.

Evacuation and dehydration of the system:

The pressure in the pipes is reduced to 1 psig and they are emptied with a high vacuum pump until it reaches a pressure of 1,500 microns. The vacuum is broken with up to 1 psig coolant and the evacuation is repeated at 1,500 microns. It is loaded with coolant again with up to 1 psig coolant and a deep vacuum will be done until an absolute pressure of 500 microns is reached. Once this is achieved, it is broken with coolant to a pressure of 2 psig.

Coolant load:

The weight of the coolant needed for the system to work correctly shall be calculated and an electronic scale will be used in introducing the amount of coolant with the system on. Once the loading is complete, measures shall be taken to superheat in the TXV and sub cool the condensing unit so that, by these means, the optimum functioning of the system is verified.

Thermal insulation:

The suction line shall be insulated with a closed cell flexible hose that is equal, or a similar one that is approved, to RUBATEX that is a minimum of ½" thick and installed in accordance with the manufacturer's recommendations. Insulation with 35 Kg/m3 polyurethane wrap, lined with aluminum foil as a vapor barrier and covered with a 0.7 mm aluminum sheet as a mechanical protection jacket. In this case, neither screws nor rivets may be used but rather aluminum bands.

3.8.3 Tests and balance/stability

Description:

The contractor will provide the specialized personnel and tools needed to do the balancing of the air flows before the system is finally/definitely turned over to the client and after all the mounting is finished.

Air conduction systems:

Main branches: By means of a pitot tube, direct reader or other tool, the flow through each branch shall be determined and adjusted if it is not in line with specifications.

Secondary branches: using procedures analogous to the above, the flows given for each vent shall be calculated and balanced. The flows shall be adjusted using the dampers provided in each vent until the required flow is obtained.

In those cases where the flow sought is not achieved, any changes necessary to reach the specifications shall be made at the contractor's cost.

3.8.3.1 Refrigeration circuits:

The refrigeration circuits and controls shall be calibrated to achieve the optimal coolant load, the desired cooling effect and check the operation of the system within the parameters of the design.

In the case of console type evaporators (wall mounted, cassette, suspended from the ceiling, etc.), the correct functioning of the system for changing air flow which is electronically controlled shall be confirmed.

The contractor will turn over a protocol of tests and calibrations which shows the parameters of the system components and serves as a guide for future maintenance and analysis.

3.8.3.2 Development:

The contractor shall instruct the personnel designated by the contractor in operating these units. He will give the norms for controlling the systems and prepare and turn over an operating and servicing manual for the systems installed as well as the plans based on the work which contains the exact and definitive information on the systems installed.

3.8.4 Mechanical maintenance

The CONTRACTOR shall supply the knowledge and labor needed for the correct operation and for all of the corrective and preventive maintenance necessary on all of the equipment and controls supplied in this contract. This obligation will stand for one (1) year starting from when the installation is finally turned over.

Operation:

The contractor will accept calls made to him with respect to any problem that appears in the operations of the equipment supplied under this contract and will take the necessary measures within the next six hours to correct any deficiency that exists.

Maintenance:

The CONTRACTOR will make monthly visits to inspect all of the equipment and take notes of the results on an inspection sheet specified later. Entrances permits shall be requested to the Police Base officer in charge.

Inspection sheet:

The CONTRACTOR will provide an inspection sheet and place a copy of it in the main machine room. This sheet will have a list of all of the air conditioning equipment provided under this contract. The inspection sheet will have space for the next 12 months to be able to indicate that he has complied with the inspection.

The CONTRACTOR shall certify on this inspection sheet that he has examined each part of the equipment and that, in his opinion, it is operating as recommended by the manufacturer, that it has been lubricated correctly and that all of the corrective and preventive maintenance operations have been done in accordance with the recommendations of the manufacturer and normal accepted practices.

4 FINISHES

4.1 OVERVIEW

Upon finishing the job, the contractor must leave a minimum percentage of all materials for use as spare parts in inventory in the case they are susceptible to be discontinued as the following:

- Ceramic 0.20m x 0.25m wall tiles. Valencia by Mancesa. (2 Boxes)
- Gray Urban double traffic Porcelain type floor Ref: 486022501 (2 Boxes)
- Teca wood Floor (2 sq mt)
- Teca wood Ceiling (8 pieces)

4.2 ROOFING

4.2.1 Simple roof in Hunter Douglas Aluzic 500C or its equivalent

Description

This item includes the supply and installation of a simple roof, Hunter Douglas Aluzic 500C or its equivalent. They will be installed with 1" hexagon head screws and drill bit. Around the perforation, a SikaBond-520 E type fast-drying mounting adhesive or its equivalent shall be applied to restrict the movement of the anchors with respect to vibration.

Development

The roof will be built pre-painted at the factory on both sides using a paint that is resistant to harsh weather conditions. This item includes the molding, unions, connections and necessary splices to secure the joining. Attachments must be made by means of self-tapping screws and with neoprene seals. Once the roof is installed, it must be submitted to the necessary test to insure that there are no leaks. The shingles will be placed on metal purlins in accordance with structural plans. They should be attached with galvanized screws with hexagonal heads, washers, and neoprene seal washers.

4.2.2 8mm Polycarbonate Roof

Description

This specification refers to the supply and installation of a roof in a 8mm alveolar polycarbonate with ultraviolet radiation protection.

Development

The installation must be done using a mounting system designed for alveolar polycarbonate sheets with self-screwing bolts fixed to the structure, the sheets must be previously drilled to avoid fractures. A 3mm span must be left between sheets to allow dilatations caused by thermal loads. The exposed edges and joints must be covered with plastic profiles according with manufacturer recommendations. The protective film must be removed after the installation of the sheets.

4.2.3 20 Gauge Galvanized Metal Sheet Channels

Description

This specification refers to the installation of channels made of 20 gauge galvanized metal sheet based on the shape and dimensions established in the detailed drawings.

Development

Based on detailed drawings, the rainwater shall be collected by channels made of 22-gauge galvanized metal sheets. Their shape will be that necessary to guarantee efficient protection and the manufacturing will be based on variations in the sheet dimensions in order to avoid over costs due to generation of leftovers. With rivets and sikaflex in the joints and coated with wash primer.

Materials

Gauge 20 galvanized metal sheet based on the work shown in the drawings.

4.3 CEILINGS

4.3.1 Drywall type Ceiling

Description:

This item refers to the supply and installation of drywall type smooth finish ceiling for hallways based on architectural details and location on the drawings. They shall be perfectly leveled and will be installed in accordance with instructions provided by the manufacturer. The height of the ceiling shall be 2.80 m above the fine level of the floor.

Development:

Suspended ceiling made of smooth drywall panels attached to tubular profile frame shall be installed. The ceiling must comply with the regulations against fires. The ceiling shall be perfectly finished and with proper joints between the profile frame sections. The storage, transportation and installation shall follow the recommendations of the manufacturer.

4.3.2 Superboard Ceiling

Description:

This item refers to the supply and installation of 12mm superboard ceiling according to architectural details and location on the drawings. They shall be perfectly leveled and will be installed in accordance with instructions provided by the manufacturer.

Development:

Suspended ceiling made of smooth 12 mm superboard panels attached to tubular profile frame shall be installed. The ceiling must comply with the regulations against fires. The ceiling shall be perfectly finished and with proper joints between the profile frame sections. The storage, transportation and installation shall follow the recommendations of the manufacturer.

4.3.3 Teca wood Ceiling

Description:

This item refers to the supply and installation of teca wood ceiling in the central hall.

Development:

The ceiling shall be built in Teca wood (100% tectona grandis) with 12cm x 2.4cm boards with lengths according to drawings. The anchorage must be done with hidden screws protected of humidity on metal structure. 3 coats of lacquer must be applied over the whole structure. The laquers must be Carls Deck oil Swedish Bona brand or Aquantur, Italian Carver brand or it's equivalent.

4.4 FLOOR FINISHING

4.4.1 Gray Urban double traffic Porcelain type floor Ref: 486022501 or equivalent

Description:

This item refers to the supply and installation of a Gray Urban double traffic porcelain type floor Ref: 486022501 or its equivalent for the floor of the offices, bedrooms, service area and auditorium.

Development:

The support surface shall be clean of grease, dust, paint and other substances that would impede adherence and perfectly leveled. Deviation from flatness shall not exceed 3mm. If it is necessary to level it, this shall be done with 1 part cement and 4 to 7 parts sand or with leveling filler, then leaving it to harden. A bed of sand should never be placed due to the possibility of deforming.

To apply the cement, water shall be poured into a container based on the proportion indicated and the cement added. Mix with a mechanical or electrical mixer at low speed. When the filler is homogenous and free of lumps, let it settle for approximately 2 to 10 minutes before applying it. Shake it again and spread a thin layer forming small stretches of 1-2 sq meters using a smooth trowel. After that brush the surface with a serrated trowel to get the density desired based on the format. Place the tiles by tapping them with a white or transparent rubber mallet to make the leveling uniform. A black mallet shall not be used since it will stain the porcelain tiles.

The joints shall be flexible, waterproof, permeable to water vapor, resistant to attack by mold/mildew and chemicals. A minimum joint of 2mm wide is recommended for modified pieces and 3mm for regular pieces.

4.4.2 BASF Mastertop 1116 Epoxy Coat for concrete floor (Technical Section) or equivalent

Description:

This item refers to the supply and application of a two component epoxy coating of low density using solvents and polyamide hardener on the floor of the technical section. Two 0.02 cms coats shall be applied in accordance with the manufacturer instructions. The anchorage profile must be CSP3. Concrete humidity must be 4% and solid percentage 60%

4.4.3 Teca wood Floor

Description:

This item refers to the supply and installation of teca wood floor for the floor of the central bridge..

Development:

The floor shall be built in Teca wood (100% tectona grandis) with 8cm x 2cm boards with lengths according to drawings, separated 2mm to allow drainage and expansion. The anchorage must be done with hidden screws protected of humidity on metal structure. 3 coats of lacquer must be applied over the whole structure. The lacquers must be Carls Deck oil Swedish Bona brand or Aquantur, Italian Carver brand or it's equivalent.

4.5 TILES

4.5.1 Ceramic 0.20m x 0.25m wall tiles. Valencia by Mancesa or its equivalent

Description

This specification refers to the minimum requirements for top quality, 0.20 x 0.25 m ceramic, Valencia de Mancesa wall tiles or their equivalent and with a color to be chosen by INL.

Development

These must be left submerged in water for 24 hours before they are cemented to a humid wall. They will be covered with 1:4 mortar while taking care that 100% of the surface of the ceramic tile is covered and they will be grouted with thin white cement. After 3 hours they will be cleaned with a clean, damp rag. The placing of the ceramic tile must start from the top row at the top of the wall which is to be covered. They must be aligned and leveled row by row. They will be placed on all the bathroom walls up to the height indicated in architectural plans. Metallic corners must be installed on edged corners. Floor or wall tiles that are

misshapen, have edges that are in poor shape or a different color tone will not be accepted. Remnants or pieces of these tiles must be in the corners or less visible places.

4.6 PAINTS

4.6.1 Paints for interior and exterior walls

Description

This specification refers to the supply and application of high quality paints, Koraza for exteriors and vinyl for interiors or their equivalent for walls directly on the plaster.

Development

All surfaces will be painted over plaster that is free of roughness. Three coats of Pintuco Koraza quality paint will be applied or its equivalent in a color chosen by the Embassy. Lineal edges and expansions will be included.

4.6.2 Paint for drywall ceilings

Description:

This specification refers to the supply and application of interior latex paint or equivalent on the drywall panels for ceilings.

Application:

The surfaces of the panels will be painted directly and shall be free of rough spots. Three coats of white Pintuco latex paint or equivalent will be applied. The price per square meter will include profiles, trimming and bulge joints.

4.7 TOILETS

4.7.1 Toilets: Acuacer Plus by Corona or its equivalent

Description

This refers to the supply and installation of white porcelain toilets with toilet seat. Acuacer Plus by Corona or its equivalent. They shall be installed in all bathrooms following instructions given by the manufacturer. Must be perfectly leveled.

4.7.2 Bathroom sink: Pettite ref 01902 by Corona or equivalent

Description:

This refers to the provision and installation of white porcelain enamel sinks Corona brand line PETTITE REF: 01902 or equivalent. The installation will be done in accordance with the instructions given by the manufacturer. They must be perfectly level.

4.7.3 Roble de Grival sink faucets REF CROMO 791229991 or equivalent

Description:

This refers to the supply and installation of Roble by Grival line sink faucets or its equivalent Ref: 791229991 for all bathrooms. Their installation shall be done in accordance with the instructions of the manufacturer and they shall be located in the places indicated on the plans. They shall be perfectly level and placed following the manufacturer's instructions.

4.7.4 Roble de Grival shower faucets Ref: OR4100001 or equivalent

Description:

This refers to the supply and installation of Roble de Grival line shower faucets and register or its equivalent Ref: OR4100001 for all bathrooms. Their installation shall be done in accordance with the instructions of the manufacturer and they shall be located in the places indicated on the plans. They shall be perfectly level and placed following the manufacturer's instructions.

4.7.5 Plastic cover for Register

Description:

This refers to the supply and installation of a 20X20 white, Dinascol, plastic cover for the register or its equivalent to be located in the bathrooms in general and other sites that require a register. Their installation will be done in accordance with manufacturer's instructions and located in the places indicated on the plans. They must be perfectly aligned and placed in accordance with manufacturer's instructions.

4.7.6 3" x 2" Floor vent

Description:

This refers to the supply and installation of round, 3" x 2" aluminum floor drain top. Reference Colrejillas or of equivalent quality. Must be perfectly leveled and integrated into the surface of the floor

Push type Liquid soap dispenser to be mounted on the countertop 4.7.13
Description

This refers to the supply and installation of a liquid soap dispenser to be mounted on the countertop. Nozzle spout 6" long and stainless steel top 304. The body and tube are ABS engineered. Tank capacity is 1 liter or 0.6 liters, Docol brand or its equivalent. It shall be installed where indicated on the architectural plans. They will be filter-tipped, fitted with white cement or zinc-white cement grouting.

4.7.7 Bathroom fixtures. Chrome type

Description:

This refers to the supply and installation of chrome grival fixtures or their equivalent for the bathrooms adjoining the bedrooms. They include toothbrush holder, soap holder, toilet paper holder, ring towel holder, rod towel holder. They shall be installed in accordance with the instructions given by the manufacturer and placed where indicated by the plans. They shall be perfectly leveled/aligned and placed following the manufacturer's instructions.

4.8 WOOD CARPENTRY

4.8.1 Hollow-core wood doors with louver (P-2)

Description

This item refers to the supply and installation of hollow-core wood doors (See door diagram). They will be installed in accordance with instructions given by the manufacturer.

Development

The doors will be made of 9 mm pizano or cativo plywood or its equivalent interior in dry and preserved sajo wood, 1.5 m cedar frame and Cypress Camel 1489 F8 Formica veneer or equivalent. The doors must have a wooden louver according to designs to allow ventilation. This item will include the 18 gauge galvanized sheet door frame with electrostatic coating. The clearances between the frames and the walls shall be sealed with silicone, sikaflex or equivalent for soundproofing. Four 3" X 3" VERA type hinges or equivalent will be installed based on their distribution in the drawings. The storage, transportation and installation shall follow the recommendations from the manufacturer.

In addition, the following items will be installed on the doors based on the drawings:

Schlage Saturno single "S" cylinder deadbolt lock or equivalent.

4.8.2 Wooden closets

Description:

This item refers to the supply and installation of wood closets (see furniture table). They shall be installed in accordance with the instructions given by the manufacturer in the spaces available on the plans.

Development:

Closets built of pizano hollow-core plywood type or equivalent for the divisions and shelves. Smooth, hollow-core doors and drawers shall be made of "sajo" wood or its equivalent. The side edging will be covered with "sajo" wood frames or equivalent. Each door shall have three hinges, metallic handle and "lira" bump. A metallic 1" pipe shall be installed.

4.9 METALLIC CARPENTRY

4.9.1 Hollow Core caliber 18 Steel Doors painted with anticorrosive paint (P-1)

Description

This item refers to the supply and installation of hollow core caliber 18 steel sheet doors, with anticorrosive paint color according to the representative of the United States Government (See door diagram). They will be installed in accordance with instructions given by the manufacturer.

Development

Hollow core caliber 18 sheet steel doors with anticorrosive paint will have an internal longitudinal reinforcement every 10 cm and an additional reinforcement in caliber 3 x 16 metal flange for hinge and lock protection. This item will include the 18 gauge galvanized sheet door frame with electrostatic coating. The clearances between the frames and the walls shall be sealed with silicone, sikaflex or equivalent for soundproofing. Four 3" X 3" VERA type hinges or equivalent will be installed based on their distribution in the drawings. The storage, transportation and installation shall follow the recommendations from the manufacturer.

In addition to the doors and in accordance with the plans the following will be installed:

Schlage Jupiter Door lever mate chrome or equivalent.

Schlage Doble cilinder security lock fix deadbolt cilinder ref:B362 or equivalent

4.9.2 Aluminum and fiberglass insect screen door (P-3)

Description

This refers to the supply and setting up of an aluminum and Phifer (or its equivalent) fiberglass insect screen door. It shall be 0.011 in caliber as shown in the architectural detail drawings and location on the plans. It shall be installed according to the manufacturer's instructions.

Procedure

The door will be built of 20mc aluminum in a natural matte color and Phifer (or its equivalent) caliber 0.011mm fiberglass insect screen with aluminum and nylon fittings, stainless steel screws and polypropylene with high efficiency barriers. Storage, transportation and installation will be done in accordance with manufacturer's recommendations.

In addition to the doors and in accordance with the plans the following will be installed:

Falcon Schlage brand aluminum color anti-panic lock or its equivalent.

Falcon RW by Schlage brand heavywork hydraulic door closer or its equivalent.

4.9.3 Shower doors in 6mm tempered glass (P-12)

Description

This refers to the supply and installation of swinging doors and fix in 6mm tempered glass with fittings and anchors in stainless steel. Storage, transportation, and installation must be in accordance with manufacturer's recommendations.

4.9.4 Metallic railing

Description:

This item refers to the supply and installation of a railing in galvanized metallic tube based on the architectural detail drawing and location on the plans. It shall be perfectly aligned and be placed in accordance with the instructions given by the manufacturer.

Development:

The railing shall be made of galvanized metallic pipe. It will be 1.00m in height. It shall have a double crosspiece at the mid-point of its height.

4.9.5 Doors in chain link mesh (P-5, P-6, P-7)

Description

This item refers to the supply and installation of doors in chain link mesh for the technical area following architectural designs and location on the plans.

Development

These doors will be caliber 10 chain link mesh with 1½" holes framed in 2" galvanized pipes and frame at a 2 x 1/8" angle and secured by 1 ½" x 1/8 metal strips on all four sides to prevent it from coming loose. They will include pins between sheets and towards the floor and locks. They will be painted with an anticorrosive and finishing paint. Ease of movement, maintenance and perfect stability for the door must be secured.

4.9.6 Screens in chain link mesh

Description

This item refers to the supply and installation of screens in galvanized chain link mesh to separate the luggage storage room and the gas tank area according to architectural designs and location on the plans.

Development

The screen will be a caliber 10 chain link mesh with 1½" holes. It should be framed at a 2" angle and secured by 1½" x 1/8 metal strips on all four sides to prevent it from coming loose and be fixed to 2" diameter steel pipes. A layer of anticorrosive paint will be applied and afterwards a finishing paint.

4.9.7 Aluminum windows

Description

This item refers to the supply and installation of windows, as shown in the architectural detail drawings and location on the plans. They will be installed in accordance with manufacturer's instructions.

Development

The windows shall be in, anodized 3" x 1½" tubular aluminum filled with polyurethane foam attached to the wall by No. 10 x 3" screw and plastic anchor with 3+3 glass laminated, or its equivalent, on the specifications of the manufacturer and the table of windows. They will have aluminum and nylon fittings, stainless steel screws, polypropylene stripping with high efficiency barriers. They will have vertical and horizontal glass stop in aluminum. Spaces between frames and walls will be sealed with silicone, sikaflex or their equivalent to prevent noise filtration. Storage, transportation and installation will be done in accordance with manufacturer recommendations.

4.10 LOCKS AND MIRRORS

4.10.1 Locks

Description

The specifications for locks are included with each type of door and must be delivered installed and secured to the door in all cases in accordance with the manufacturer recommendations. The keys for the locks must be tested and three copies must be turned over to the to the final user with an inventory showing the places they correspond to.

A master key for all locks will be given to the Embassy's person in charge. (See detailed drawings)

4.10.2 Hydraulic lever

Description:

Refers to the supply and installation of Schlage hydraulic door closers/heavy duty Falcon RW or their equivalent.

Development:

The arm or door closers must be delivered installed and secured to the door in all cases as indicated on the detail drawings and manufacturer's recommendations.

4.10.3 Schlage Falcon anti-panic lock or its equivalent

Description:

This item refers to the supply and installation of Schalage Falcon aluminum colored anti-panic locks or their equivalent as they appear in the door detail drawings for the main accesses, emergency exits and hallway doors.

Development:

The lock must be delivered already installed and fastened to the door and in perfect working condition in all cases according to the indications on the detail drawings and manufacturer's recommendations.

4.10.4 Mirrors

4.10.4.1 5mm Mirrors.

Description:

This item refers to supply and placing of the mirrors in the bathrooms in the places indicated on the detail drawings.

Development:

Mirrors will have the dimensions in the designs and be placed above the counter back splash and horizontal divisions in unified dimensions in accordance with the size of the sheet. Mirrors will be attached with a 2-sided tape well secured to the wall and perfectly leveled and even with the level of the wall tile. Top quality gray crystal mirrors floated and with a minimum thickness of 5 mm will be used.

5 CONTINUOUS ACTIVITIES DURING AND AT END OF WORK

5.1 CLEANING AND HOUSEKEEPING

5.1.1 General clean up

Description:

This specification refers to clean up during construction and at the end of the job.

Development:

During the entire construction period, there must be places previously agreed upon with Embassy United States Government or its representative where construction debris and rubbish can be kept. This place must be easily accessible from public roads for easy removal from job site. The builder must provide the necessary physical and human resources for loading and transporting this debris.

The items must include the general clean up and removal of debris to the nearest dumpsite outside the Base that is authorized (by the municipality or, if that is not possible, authorized by the Base or Embassy representative). At the same time, terrain next to the site must be turned over in the same condition it was in prior to the job (with grass, gravel, sidewalk, floor finish, or whatever applies to the case). Materials from anything that was demolished and debris from the construction work will be deposited while avoiding any obstruction of the entrance to the site, internal roadways or any occupation of public roads in areas previously defined while the material is loaded in dump trucks for the removal.

The contractor will provide the personnel and equipment necessary to remove the materials from the streets and sidewalks next to the site (inside and outside of the police installations) scattered by the dump trucks throughout the time work lasts thus complying with Environmental Ministry resolution 00541 of December 14,

1994 or the latest regulations in force. This work, along with the clean up inside the Base will be included in the cost of each item. Once the job or part of it is finished and before it is finally turned over to the Embassy, the contractor will proceed to disassemble and demolish the temporary installations built for the site administration and remove all excess materials, debris, residue and will do a general cleanup of all interior and exterior areas of the building where the work has been going on as well as wherever the Embassy so indicates.

The contractor will keep all job areas clean continuously by avoiding the accumulation of trash. This will be transported to the authorized sites or dumps outside of Base installations. Under no circumstance will the burning of trash will be authorized on site. Clean up will be done at the end of each work day.

All parts of the construction shall be completely clean and installation and devices will be in perfect working condition when the job is turned over. Floors shall be spotless when they are turned over. All cement residue, concrete, dust, grease, paint, etc. must be removed as construction is going on and the floors protected with plastic and cardboard.

When the work is finished, we will proceed to do a general cleaning of roofs, walls, furniture, windows, doors, yards, paved areas, etc. The proper equipment, substances and materials will be used for correct cleaning based on the manufacturer's instructions and taking care that this will not damage the finish of the building components.

All necessary repairs shall be done on work that has deteriorated during the construction process so that it is turned over with the proper appearance without these repairs generating an additional cost.

Floors and walls with ceramic tile and sanitary devices should be cleaned with muriatic acid or nitric acid in the concentrations recommended by the suppliers. Granite floors will be washed with brush, water and soap. Windows will be freed of debris while taking care to not damage the finish on the frames. Any residue adhering to glass should be totally removed.

5.2 CONFORMATION FILL IN AND SODDING

5.2.1 Conformations fill in

Description:

This specification refers mainly to the formation of fill-ins must be done around gravel areas and sidewalks that are next to grassy areas to be at their same level.

Development:

Embankment and fill-ins will be built in accordance with the alignments, elevations, slopes; transversal sections indicated in general plans while taking into account the thickness of the organic layer of black earth that will support grass. The material for the fill-in will be obtained after a rigorous selection of remains from the excavation. The United States Government or its representative must approve type, quantity, quality and method for laying it down.

It will be applied in successive layers and placed over total width of the section. The materials will be spread in horizontal layers the thickness of which may not go over 10 cm and will be watered to reach the level of saturation ordered by the United States Government or its representative.

Materials:

Materials coming from excavations must have the United States Government or its representative's approval.

5.3 SODDING

Description:

This item refers to grassing with 0.50m x 0.50m sod sections along the sides next to roadways between the administrative buildings and living quarters.

Development:

Sodding will be done with 0.50m x 0.50m machine cut sod sections over a layer of black earth that is 0.10 m in thickness. The soil must be prepared with lime in quantities of 1 Kg. per m³ and mixed with rice husks in an 8:1 proportion. The moisture in the soil at the moment the sod sections are laid. They must not be laid on ground that is very dry. The sod sections must be watered right after they are laid down. The contractor guarantees the germination, regular watering and cutting of the grass for 3 months after the job is turned over.

Materials:

Machine cut sod sections that are 0.50m x 0.50m and black soil.

6 SUPPLIES

6.1 ELECTRIC EQUIPMENT

6.1.1 Electricity generation system for emergency electrical plant

An electricity generator that has an effective capacity of 150KVA shall be provided and installed will supply electricity services at level of Tulua, Valle. The equipment will have fuel tanks that will give the base 8 hours of autonomy at full load. The generator will be covered based on the area that appears on the location diagram. The contractor must specify its location on the design in case the plans annexed to this sheet do not satisfy the expectations for its design. The reason or justification for choosing this the system is the cost and maintenance based on IEEE-142 and performance. The contractor must do the maintenance of the generator and its accesories including oil change and filters. Thin maintenance must be done according with the characteristics of the equipment and the manufacturer instructions. The recommended brands are: Caterpillar, FG Wilson, onan Cummins or equivalents.

Overview of the system

The plant will provide 208V/120V of electricity which will go to the automatic transfer. All the components of the plant, as well as their fittings and equipment will have to be new and from a commercially standardized production line by a manufacturer with broad experience. The plant will have to be made in compliance with the specific requirements applicable to the ASA, ASTM, NEMA, SAE or DIN norms. The unit will consist of a diesel engine directly connected to an electrical generator by means of a semi-flexible steel disk coupling which includes the corresponding controls and protection equipment. This generating motor equipment will be suitable for the operation of a 3-phase, 4-wire, 208/120 V, 60 Hertz system and will provide 225KVA of effective power. It will be inside a soundproof room which will have a ventilation grille and doors. The contractor will enclose the statistical calculations for the plant under these operating conditions.

The plant will have a grounding system for the power system and if necessary, it will be equipped with a concrete vibration-proof base. The system will have a duct for venting gas. In conclusion, the emergency system will have the following components that must be well defined by the contractor:

- a) Soundproof cabin maximum 78 dB a 2 meters of the generator
- b) Generating power unit

- c) Fuel tank at the base of the generator
- d) Batteries
- e) Battery charger
- f) Coupling for air and ventilation grille
- g) Silencer and gas venting duct
- h) Grounding system to connect the generating power unit and fuel tank

Generator

The generator will be synchronous with four (4) poles without brushes and have a capacity of 150KVA, which will work when there are cut-offs in the flow of medium tension electricity. A factor of 0.8 power, frequency of 60 Hertz, three-phase, 4 treads, to work with tension of voltage service at full capacity of 208 Volts, and a speed of 1,800 RPM. The rotor will have to be dynamically balanced with a one to two bearing system and permanently aligned to the motor with a flexible coupling. The output will have to be three-phase with complete wave correction and solid state components. It will have to be static, mounted on the common axis of the rotor and be easily accessible for inspection and maintenance. The voltage regulator will have to keep the service tension within a range that is no greater than + 2.0% of the variation in the nominal voltage of the entire range of the charge. The instantaneous drop in voltage should not be greater than 2.5% when applying the full load of a factor of power 0.8. The alternator should allow a recovery of the voltage in a lapse of no more than two (2) seconds after there has been a steep change in the load of between 25% and the 100% of the capacity of the alternator. It will also be provided with a rheostat to make 5% adjustments in voltage or more. Alternator cooling will be done by means of a centrifugal ventilator that has a low level of noise and provides the necessary cooling for the rotor and stator. The insulation for the alternator will be NEMA, class H using epoxy resins that give suitable protection from the environment and abrasion. The alternator must be able to provide – without harmful over heating—an auxiliary capacity of 110% of the nominal capacity with a factor of 0.8 power (FP) 0.8 for a period of 5 minutes. The generator comes with a box that has connections for 4 cables (3 phases and neutral) and twelve (12) terminals with three phase industrial switch

Diesel engine

The motor will have the following characteristics: diesel, turbocharger, cold start, four gears, with cylinders in line or V, normal speed of operation 1,800 RPM and the characteristics and capacity necessary to drive the generator under the established operating conditions. It will be provided with an automatic regulating system during operation. This will also include a metal base and anchoring bolts for the total motor-generator system. The power output will not be superior to 1.5 BHP/KW at 1800 RPM and the conditions established for its site of operation.

• Fuel system

The fuel that should be used so that it operates correctly under the stated climate conditions will be that for diesel engines. The motor must be able to operate over long periods with low loads. Therefore it will have to have what is necessary to prevent residue build-up. Each cylinder must have its own fuel injection pump controlled by the governor, injection valve and replaceable parts filter. The tank must be equipped with an automatic floater which controls the fuel flow, a drainage plug, vent, upper gas cap for manual filling, register valve for machine filling. Also a flexible coupling in copper pipe should be provided with the caliber demanded by the manufacturer in order to connect to the plant that was provided. Finally, it will have a measuring stick to control the level.

• Lubrication System

The motor will use forced lubrication by means of a gear pump with positive displacement that allows lubrication of all moving parts with a total flow filter which will have to be made of replaceable parts. The lubrication system must have a water or air cooling system and will be provided with a thermometer and visual indicator of the level.

- **Speed governor**

The motor will be equipped with a self-lubricating closed construction speed governor with and able to exert a control over speed with 5% precision over the entire range of the maximum charge. It will have to interrupt the fuel flow when the machine reaches the overdrive limit that is guaranteed by the manufacturer.

- **Cooling System**

The motor must have a water cooling system that has sufficient capacity to keep the engine at an acceptable temperature when it is working at a full load. It will be equipped with a centrifugal water recirculation pump and thermostatic valve. The water cooling system will work through the radiator. The manufacturer will provide the cooling system with all the devices required for optimal operation such as: pumps, valves, solenoids, thermostat, etc.

- **Air supply**

The air intake of the motor will have to be provided with one or more dry filters with replaceable parts. The manufacturer must provide all the parts such as hoses, supports and openings built into the wall to leave the air intake system outside the cover.

- **Venting System**

The contractor must design, construct and mount the complete system for venting exhaust gases from the plant. The escape ducts will have to be large enough that the back pressure on the escape system does not exceed that which allows the engine to produce the maximum capacity required to operate correctly. Considering that when the plant is operating the noise can get to be annoying, the system will have to be provided with a cushioning silencer for critical use with flexible metal hoses to facilitate its installation. All the pipes or ducts that are within people's reach must be covered with a coating in fiberglass with aluminum foil.

- **Starting system**

The motor must be equipped with an electrical starting system with enough capacity to accelerate the motor until it reaches a speed that allows it to start under the conditions stipulated for the operation site of the plant. The electrical motor will have to be battery fed and will have a starting solenoid and a BENDIX type clutch or its equivalent.

- **Protective parts**

The motor will be equipped with automatic controls and visual or audible alarm indicators so that the machine is stopped in each one of the following cases:

- a) Low oil lubrication pressure.
- b) High water temperature.
- c) Engine over velocity limits.
- d) Automatic shut-off by lack of fuel.
- e) Overcharge.

- **Instrument Digital Board**

The following parts, protected from vibrations, should be mounted on a board to control the motor:

- a) Oil pressure gauge.
- b) Thermometer for the temperature of cooling water.
- c) Ampere meter for battery charge.
- d) Start-up button and stop button for the engine
- e) The protective parts previously mentioned
- f) Horometer to indicate the length of time the machine has been operating.

• **Set of batteries and stabilizers**

The manufacturer of the plant must provide it with a system of storage battery cells with sufficient capacity to allow engine start-up operation in a period of two (2) minutes. The battery will be provided with a stabilizing type of automatic charger by semiconductor with a capacity to provide continuous charging of the batteries plus 25% and will allow the batteries take energy from both the normal source and the emergency source. Its compensation will have to allow variations of $\pm 10\%$ in the feeding tension over voltage, and frequency variations of $\pm 5\%$ over the nominal value of 60 Hertz. The charger must have a DVM, an automatic breaker, light signal selector switch for slow and fast charge as well as a grounding indicator. For its installation, the complete set of batteries and stabilizer will be provided with the necessary support for the batteries, connecting cable, terminals and other parts.

• **Control of starting and shutdown**

Along with the plant, a panel for the operation of starting and shutdown of the plant will be provided. This panel will have to include: A device that provides a suitable series of starting and shutdown cycles when it receives a suspension signal for the normal energy flow and as soon as the motor goes into operation, it suspends the feeding of the battery circuit. The four (4) positions on the selector switch are:

- a) Manual: Which locks out the automatic characteristics and allows the plant to be started manually.
- b) Turned off: Where automation is eliminated and allows the manual start-up of the plant.
- c) Automatic: In which the automatic operation sequence is connected.
- d) Test: In which a failure in the normal power plant is simulated and allows the generator to start up.

• **Soundproof booth**

The booth will be modular, semi-encapsulated portable and self supported, made of metallic panels with insulating treatment and detachable. The parts of the cabin must allow easy assembly and disassembly, lateral access doors and a window that allows the controls to be seen from the outside. The panels will be made in C.R. sheeting caliber N°14-12 finished with weather resistant paint. On the inner part of the panel, the acoustic treatment will be improved with material that cushions the noise level (mineral wool or its equivalent). It will be supported and stiffened with mesh or metal supports. The cold air intake will be on the side of the generator and will be a window with venetian blinds with a formation that allows the attenuation of the noise. The air exiting in front of the radiator will attenuate noise through the countercurrent panels which will have suitable proportions. The noise conditions due to the location and the characteristics of its use are not critical and guaranteeing a level of 65 dB at two (2) meters away from the radiator is considered sufficient.

• **Electronic transference**

The contractor must supply and install of an electronic transfer, which commutates the primary and emergency network services in the event that either of the two should fail or have problems of too high or too low a voltage. The transference must have cocking mechanisms and a system of programming to control and to adjust delay time between a fall of tension in the primary network and plant, the repositioning time once service is reestablished, adjustments in the firing limit due to high or low tension along with other variables. The transference goes inside a panel with the same characteristics mentioned in the medium tension sections.